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Rotraut Walden *Editor*

Schools for the Future

Design Proposals from Architectural Psychology

Springer

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Design Proposals from Architectural Psychology

With a foreword by Prof. Henry Sanoff and comments by Prof. Peter Hübner & Friedensreich Hundertwasser

Springer

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Foreword

Henry Sanoff

School facilities are powerful indicators of community values and aspirations. They not only support the academic needs of students they serve, but can also address the social, educational, recreational, and personal needs of the members of the broader community. It has been argued that successful schools strengthen a community's sense of identity and coherence.

Educational reform, however, has focused primarily on what is taught, and how it is taught. As a result, curricula have been strengthened, instructional strategies improved, and learning materials updated. However, what has received too little attention is the physical environment in which education occurs. School systems find that parents are much more discerning about which school their child will attend, including the physical appearance of the school and the amount of modern technology available. In addition, school systems have discovered that schools with "sick" internal physical environments are shunned by prospective teachers and parents alike (Stevenson, 2006). Widespread misconceptions reinforce the view that the quality of school buildings has no impact on academic performance. Consequently, a gap exists between the educators' view of improving quality and the process of planning schools.

It is also becoming more evident that students function best in different educational settings according to their abilities, consequently identical schools in terms of facilities do not equate with equal opportunity for students. School systems in the USA are offering parents and children more choices about the school a child attends. The one-size-fits-all approach is gradually disappearing, and may give way to smaller and more diverse learning environments that give parents and students more choices and options about what, where, and how they learn. Therefore, the focus is shifting away from district-wide planning providing equality of school facilities towards plans that meet the unique program needs of each school (Stevenson, 2002). And as parents have more choices about where to send their children, it follows that they demand schools that are personalized and that fit their needs.

Very different scenarios may affect what spaces will be included in future building designs (Butin, 2000). One view of the future suggests that standard academic classrooms will disappear. In their place, specialized labs and learning centers will become the norm (Lackney, 1999). Those with this vision maintain that separating learning into academics, arts, vocational, and the like is a false dichotomy (Chan, 1996). Instead, they view learning as holistic with, for example, art incorporated into language arts or maths taught with specific job skills or vocations in mind. In this scenario, classrooms must be multipurpose, allowing a blending of traditional instruction with meaningful and diverse hands-on, lab-type experiences that may include anything from pottery making to dramatic arts. This idea of personalized learning environments, which has generated immense interest in the design of classroom clusters, house plans, and school-within-school settings has magnified the role student commons can play in a school's overall design, serving as a hub for an academic wing or providing a space for alternative teaching strategies.

Another scenario sees the development of more shared school facilities. In this view, future schools will be created or redesigned so that instructional and support spaces can also be used by social and community organizations or even businesses. The idea of schools as community learning centers has been supported by research documenting the importance of active parental involvement, the growing importance of lifelong learning, and a recognition that communities have many assets to offer that are themselves important learning tools. This awareness presents an opportunity to reconsider what constitutes an appropriate learning environment and to identify those factors that can enhance student achievement. Sharing instructional and support facilities is expected to be beneficial to both the school and the community. In such settings, students have access to a wide array of community and business expertise that can bring the curriculum to life – and those who do not normally have access to school facilities find that the facilities better justify the money spent upon them. In any of the scenarios, school facilities would be different from what exists today. The key to successful planning is to provide the most flexible and adaptable spaces possible in our schools.

The previous trends suggest how school facilities may be different in the future. Though the possibility may be remote, another scenario exists – schools, as we know them, will disappear (Northwest Educational Technology Consortium 2002). If one thinks about the combination of the rapid development of technology and the increasing lack of confidence parents have in public education, the disappearance of the brick and mortar structure called school is possible. The child has access to lessons prepared by the most knowledgeable professionals in the world and can interact electronically with teachers and students in other countries as part of language, geography, or political studies instruction. Parents who home-school increasingly use technology to access instructional materials. Students in remote areas of Canada and Australia, hundreds of miles from a school building, attend school by logging onto their computers. Technology literally allows a high school student in rural locations to take a course online from a teacher in another town.

The question, perhaps, is not whether it is possible that schools will cease to exist, but how virtual schools will grow and to what extent. No one knows, but it raises some interesting issues about how much to invest in physical structures, what kind of life expectancy they should have, and whether the future emphasis needs to be on schools as traditional learning environments or schools as production and broadcast centers. It also raises a question about the fundamental purpose of schooling. If technology consumes much of the instructional delivery of the future, who or what will assume responsibility for the socialization process that schools have traditionally been held accountable for?

Another new element to consider in school design is the reality that there are more active participants who want a voice in how new school facilities are designed. Community-based groups, municipal agencies, and universities are just a few of the groups in the past decade that have voiced their ideas. This activism has led to a greater need for authentic citizen engagement and growing acceptance of shared space and public-private partnerships. In the coming decades, educators and facility planners may increasingly be thinking about the needs of preschool children and senior citizens. In this new era of lifelong learning, educators and architects are going to have to expand their vision of who uses these facilities and be keenly aware of changing demographics. It may be necessary to move away from the traditional emphasis of creating facilities for seniors only and consider approaches that let the generations mingle in order to keep retirees active and current (Sullivan, 2002). Schools can achieve more innovative approaches to learning by creating learning environments in nontraditional settings such as museums and shopping malls, as well as encompass community needs.

The key to providing school facilities that meet current and future needs in a given community is to constantly scan the environment, communicate regularly with educators, the community, businesses, and policy makers, and stay aware of current educational, design, and environmental issues. Otherwise, reliance on “It’s always worked in the past,” or “That’s how it has always been done” may well result in the waste of capital resources, dissatisfaction in the community, and reduced opportunities to optimize instruction and educational outcomes. A basic element of effective planning for the 21st century must be "thinking beyond today." Specific questions must be asked on an ongoing basis: "What is emerging in educational practice that may affect school design tomorrow? What is happening with the demographic composition of the community that may change how education must be delivered? Does quality research exist that indicates education can be delivered in a more efficient, effective manner?" (Bingler, Quinn, & Sullivan, 2003). If such questions are addressed, can we hope that the school facilities of tomorrow will adequately support the educational programs of the day? This book would like to be seen as a first step toward the much needed discussion of these questions.

References

Bingler, S., Quinn, L., & Sullivan, K. (2003). Schools as centers of community. Washington, DC: National Clearinghouse for Educational Facilities.

Butin, D. (2000). Classrooms. Washington, DC: National Clearinghouse for Educational Facilities.

Chan, T.C. (1996). Environmental impact on student learning. Valdosta, GA: Valdosta State College.

Lackney, J.A. (1999). Reading a school building like a book: The influence of the physical school setting on learning and literacy. Jackson, MS: Educational Design Institute, Mississippi State University.

Northwest Educational Technology Consortium (2002, March). Virtual schools: What do educational leaders need to know? Paper presented at the 2002 NCCE Conference, Seattle, WA.

Stevenson, K.R. (2002). Ten educational trends shaping school planning and design. Washington, DC: National Clearinghouse for Educational Facilities.

Stevenson, K.R. (2006). Educational facilities within the context of a changing 21st century America.

Washington, DC: National Clearinghouse for Educational Facilities.

Sullivan, K. (2002). Catching the age wave: Building schools with senior citizens in mind. Washington, DC: National Clearinghouse for Educational Facilities.

Preface

We hope that our descriptions in this book of innovative schools worldwide, embedded in a framework of architectural psychology, will be able to offer a professional foundation for the construction, renovation, or expansion of existing and future schools.

Interest in this topic has in recent years gained impetus as a result of various studies evaluating pupils' performance in international comparisons, notably the triennial worldwide PISA (Programme for International Student Assessment) studies coordinated by the Organisation for Economic Cooperation and Development (OECD) that assess 15-year-olds literacy in reading, maths, and science as well as problem-solving in general. These curriculum-independent studies with a rotating particular emphasis on one of the three core areas began in 2000, and each successive round has led politicians, educators, and parents – particularly in countries not at the top of the results list – to ask why pupils in one country do better than those in another. Whilst there is, of course, no simple single-factor solution, the importance of learning environments that support various user needs is being recognized. In our search for features of supportive environments, we found that, besides teachers, parents, and other children, the school buildings themselves significantly influence performance, well-being, social behavior, and therefore also, in the end, grades as well as the knowledge and skills that pupils acquire for their future lives.

The success of an earlier book of ours on school buildings and trends in educational architecture in Germany, Schulen der Zukunft (Schools of the Future), published in 2002, encouraged us to widen our scope and address the subject on an international level. After all, how an inspiring, stimulating school should be designed will be different in different countries, according to culture and climate. There are commonalities, however, and so our proposals should be understood as a set of criteria that should be examined for applicability, and adapted to the respective local situation.

Many factors have to be considered. Depending on a country's location relative to the equator, the north or south face of a building may serve to provide cooling shade or contribute to heating the structure. But what counts as the optimal temperature is very similar in hot and cold climates, and for mental work is around 21–22° C (approximately 70° F). And depending on the climate of a specific region, one might use cool or warm colors to compensate for actual temperature deficits. Then again, there are cultural differences in the symbolic meaning attributed to colors, which will influence well-being. The need for privacy is also very different in various cultures.

User participation in the design and building processes is usually implemented according to the degree of acceptance of the organizational effort it requires, but in the view of experts it is vital for the long-term acceptance of buildings. Information technology enhances the communication of knowledge even across considerable distances, and its advance will therefore reach most schools in the future, if it has not done so already. Especially for children in need of special support, from one-parent or immigrant families, schools with a home-like atmosphere and many appropriation opportunities represent built models of a functioning home. Integration is also supported by universal design. Innovation in the regulations for school construction will have to be advanced in many countries with the help of a common design language.

The contributors to this book address all these aspects. Overall, we see our recommendations as based on an interactionist approach, which posits that performance can be promoted with school buildings, relative to the specific teaching methods, learning goals, and learning styles, the people – students and teachers – involved, the community, the general culture, and the climate. This means that there is no one single school design that will satisfy all requirements everywhere: While the recommendations we offer are clear expert-based suggestions, they remain varied and multifaceted.

Rotraut Walden
December 2014

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1 Introduction

Rotraut Walden

> *It is an unfortunate truth that dignity and freedom of thought often depend on the proportions of a room, a delightful view out of the window, a certain measure of light and color, so that someone who has spent his whole life in a kind of oblong boxes and one day enters a room with noble proportions might wonder how much he might have been missing, spiritually, just because of the character of his living quarters.*
>
> *Christian Morgenstern*
> *Steps, Psychological Issues (1906)*

1.1 Overview

Every day, we experience how spaces can influence human beings, whether we are visiting friends in their homes or entering a department store, a restaurant, or a museum. We get very different impressions, which in turn generate very different emotions and moods. Because spaces influence us, we like to design the spaces we inhabit in such a way that they make us feel comfortable and at home in them.

With public spaces such as schools, this is more difficult. The importance of the design of school spaces for successful education is often underestimated. A main finding of our studies is that students must feel comfortable in their school environment as a crucial precondition for successful learning (see Walden, 2007). It is the opinion of many experts that there are communication problems between architects and educators and the main users of schools, teachers and students. These buildings are planned by many for many users, which leads to many individual expectations falling through the cracks or never even being taken into consideration. In any case, one should be clear about the learning processes that are to be accommodated, which pedagogical concepts are to be used, and which learning goals are to be pursued with the students. If the spaces met these expectations, would we then be on the way towards "schools of the future"?

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The present study shows the future trends in school design. Perhaps we will never see the "school of the future." This might be due to very different reasons: Sometimes the architecture is inappropriate, sometimes the teachers are not sufficiently engaged, or the student community just does not allow things to get moving. Also, architectural design and furnishings will always be perceived in a subjective manner: What makes some people comfortable and content might cause discomfort or even stress in others.

Certain shapes or colors may be disliked by many users, while others are appreciated. It is necessary to find out what these preferences are, and consider them in the design of future buildings. The simplest, most sensible and successful way to do this is to include users in the planning or remodeling projects from the beginning, in the form of user participation in the design, user design and decision making (as has been done, for instance, by the architects Henry Sanoff in the United States, and Peter Hübner in Germany). This achieves an interlocking process, resulting in a final fit which is formed, carried, and acknowledged by both sides: the young users and the spatial arrangement. This makes it possible to identify with spaces. Basic human needs are located in the spheres of emotion, communication, and intellectual as well as physical development. This means that the learning environment of a school has far-reaching associations of living space, place for experience and encounter, workshop, laboratory, oasis, and way station. It also means that architects must design and plan more than walls, ceilings, roofs, and hallways – a spatial composition that is esthetically pleasing, evokes functional curiosity, invites users to enter and stay, encourages work to be done, enhances the joy of learning and performance, offers firm support in the daily routines yet opens avenues for self-actualization that extend into future careers as well as private relationships.

Some readers may consider it somewhat presumptuous to talk of a "school of the future." However, our research efforts are indeed guided by the question of what such a school might be like. In view of the demographic forecasts that envision ever increasing numbers of elderly people who will have to be "supported" by fewer younger people, this question is no mere luxury. The younger generation will have to become more capable and productive to be able to meet such expectations. Besides, many older schools are deficient in their ability to support learning, productivity, well-being, and social interaction. We are convinced that better school buildings can provide better environments for successful education.

To achieve a sense of "feeling at home" in such a school environment – where, after all, teachers and students spend a considerable amount of their time – it should be a matter of course to have students, parents and teachers contribute to the design of the school. An additional effect of such participation in improving the school is an increased sense of responsibility for this environment, of becoming creative, environmentally aware, and understanding, and a reduction in vandalism. Our project is rooted in the premise of architectural psychology, that performance and behavior of people depend on their interaction with their environment (Lewin, 1963).

1.1.1 Methodological Considerations Regarding Architectural Psychology Relationships

Regarding the many aspects which influence the experience and behavior of students, teachers, and parents in schools, Gifford (2002) asks the following question with respect to architecture: How do different building configurations influence learning? School buildings and school yards are very diverse. Some are very large, others quite tight; some look like monopoly hotels, like one-story geometric structures assembled from classroom blocks; some have lawns, while others have only tiny asphalt courtyards.

This leads to a search for 1) structuring units and their empirical relationships and 2) the conclusions that can be drawn from the results.

Regarding the first of these two points: Not only are the building forms varied, but so are the local conditions of each building, and its ecological integration. Furthermore, the people involved are very different. For pragmatic reasons, we therefore employ an interactionist approach in our investigations, which assumes that behavior is formed by both people and their environment. A structure with the elements response, situation, and person, which then permits making statements about concrete points in it, is offered by the facet theory (Borg, 1996). Conceptually, we follow the transactional approach, which assumes that that individual behavior is not only determined by the social and physical environment, but the individual in turn changes reality by his or her behavior. The transactional approach also embraces the uniqueness of problem solutions as they are described in interviews, for example (Werner & Altman, 2000, pp. 21 et sqq.). Kaminski (1988; Moore, Turtle, & Howell, 1985; see Dieckmann et al., 1998, pp. 48 et sqq.) describes a conceptual frame of reference for establishing relationships between basic environmental psychology components.

With respect to the second query arising from Gifford's questions: Researchers of older studies tended to claim that environment determines behavior. Thus, they tried to establish concrete effects of the environment on humans, based on mere correlations. Especially Linneweber (1996) pointed out the problems with this approach to deriving causal relationships, specifically with respect to environmental studies regarding school buildings.

It is legitimate to establish causal relationships when the effects can be unequivocally isolated and thus law-like relationships can be shown. But that is not the case here, an objection that can be raised for all applied social studies in general. We would like to emphasize that we, therefore, can only point out tendencies whose consequences are not equivalent to the conclusions from so-called "hard" experimental studies.

This debate mostly culminates in the conclusion that research aiming at determining results based on relationships between multiple aspects often turns out to be quite relevant for practical application (in spite of the above reservation) while experimental research may aim at establishing firmer (causal) relationships, but at the expense of being able to focus only on very small slices of reality, and therefore has very limited practical usefulness.

We cannot offer a solution to these general problems. But our discussions are guided by the view that architects rightfully expect concrete assistance from psychologists, since, after all, buildings have to be built, with or without unequivocally (experimentally) validated expert psychological advice. This dilemma leads to the search for units respectively structures and a determination of the research object by means of a combination of several different methodological approaches to the same question (see the discussion of "triangulation" in Hellbrück & Fischer, 1999, p. 115.) This is the approach we use in this study.

Our book is organized in three parts: A theoretical part with a history of school building in the Unites States (Lackney), Japan (Yanagisawa), and Germany (Schalz), basics of architectural psychology and architecture, such as psychological relationships and processes (Walden), the principle of community participation (Sanoff), the expectation for communication and information technology in schools (Yanagisawa), and a design language for learning communities (Lackney); an empirical part (Walden) containing a facet approach, interviews regarding selected schools of the future, and a format for the assessment of the quality of school buildings; and an appendix with descriptions of 24 international examples of innovative schools, in 11 countries on all five continents.

The introduction to the topic begins with a discussion of school building in earlier times (Chapter 2). A brief historical overview of school building in the USA, Japan, and Germany makes it clear that school building, just like architecture in general, is not only subject to the changing conditions of the time, but also a mirror of society. The criteria for the quality of school buildings have changed continuously.

1.1.2 Historical Perspectives

History of the Schoolhouse in the USA
In chapter 2.1, Jeffery A. Lackney outlines the history of the schoolhouse in the USA. Three definable periods of educational architecture in the United States – the Colonial period, the Industrial Revolution, and the Information Age – demonstrate how educational facilities from early one-room schoolhouses to modern-day, high-tech buildings have evolved over time in response to societal and political influences.

Historical Background of the Japanese School
Kaname Yanagisawa looks at school buildings in Japan in chapter 2.2. There were no public schools in Japan before the Meiji era other than private schools called "Hanko," which were feudal clan-owned schools for educating samurai, and "Terakoya," temple-owned schools for educating tradesmen and farmers. The modern public school system in Japan with separation of grades started in the Meiji era (1868–1912).

Central government school design guidelines were issued in 1881 and a model school plan in 1895. School features from this period are still found in many contemporary Japanese schools. While there were few changes in school design during the early 20th century, the central government organized a committee to build two model schools as symbols of Japan's postwar rehabilitation after the Second World War. Several innovative schools were built during the 1960s, demonstrating shifts from quantity to quality, and from standardization to variation.

Open plan schools were built during the 1970s, following the open plan movement in the UK and the USA. After 1984, the central government started to subsidize construction of open plan schools. Criticism of open plan schools and their lack of human scale and privacy led to innovations in school design such as a more home-like environment, the independent class house, and small enclosed spaces. These ideas have not become mainstream practice in Japan, but have had an influence even on some of the open plan schools.

The Historical Development of German School Buildings
In chapter 2.3, Simone Schalz provides an overview of the historical development of school buildings in Germany. Until the 16th century, schools in Europe were the exclusive domain of the church. At about this time, mandatory education was introduced in Germany. With the work of Johann Amos Comenius (1592–1670), the first steps towards modern pedagogy were taken. "Reform educators"

working for changes between 1890 and 1930 aimed at making the human being the central concern, and drew educational material from real life (Maria Montessori, Peter Petersen, Rudolf Steiner). Another "wave of reform" developed in the time between the two World Wars. The church became less and less important, and more steps were taken into a scientific direction. This trend continued after the Second World War, and "arousal, fun, and illusion" became key concerns.

In today's school building, the pedagogical concept often takes precedence in guiding development of educational architecture. Today, school design is mostly based on concepts which have been agreed upon ahead of time (for each individual project) – concepts which include specific expectations and requirements for the features of the school building and its immediate surroundings. Here, the choice of the right architect becomes a deciding factor. The architects face many diverse challenges. These include not only the expectation that they carry out their commission as the students' and teachers' advocate, but also try to accommodate all user requests and integrate them into the architectural concept.

1.1.3 The School of the Future

In chapter 3, we investigate the conditions that will characterize the school of the future. Well-being and readiness to learn are influenced not only by external (spatial) conditions but also by internal psychological processes: Arousal, adaptation, stress, distraction, overload, and fatigue also have their effect on well-being, social relationships, and learning performance. Spatial perception represents the border between the external and the internal world. Here, the spatial conditions such as form and color design, lighting, climate, heating, cooling and ventilation, acoustics and noise remediation, and furnishings must be considered important (see sections 3.2–3.7). Then we describe the processes and needs that are significant in view of emotional and physical well-being (see sections 3.8–3.10), such as density and crowding, privacy, conflicts and aggression, and school as a place for social encounters. Participation, user design and displays of self (see section 3.9), considerations regarding the ecological choice of building materials, with a section on education with regard to ecological responsibility, as well as clarification or organizational aspects, positions towards open instruction and after-hours community use of schools round out chapter 3. A school is not just a place for instruction but a living venue for learning and play, as well as a meeting place for users from the surrounding community. A school should not only be a place for learning processes but an open house where everybody can feel comfortable and at home.

1.1.4 International Perspectives

The book's international perspective is provided by three authors from the Unites States (Henry Sanoff and Jeffery A. Lackney) and Japan (Kaname Yanagisawa). They consider the benefits of user participation and information technology in designing living schools that offer a connection to "inner" (participation) and "global" communication. Specifically, Jeffery A. Lackney recommends a new design language for schools and learning communities that will help architects in designing and building without being overly constrained by regulations and norms. One implication of this proposal would be the amendment of regulations, educational specifications and norms (for example, the DIN norms) with the help of this design language.

Schools Designed with Community Participation

In chapter 4, Henry Sanoff explores the question of public participation in school design. It presents the rationale for such participation both in terms of classic democratic theory and from the point of view of ensuring that user concerns will be adequately addressed as well as contributing to the sense of ownership of users, discusses how participation by students, teachers, parents, and the community can be achieved, and how the resulting environments can be evaluated. The evaluation may consider user interpretation of the messages a building conveys about the activities and social values of occupants, its functional adequacy in view of different user needs including children with disabilities, how well its spaces foster the social and psychological conditions in which learning is most likely to be successful, and its esthetics. Case studies address community and user participation as an integral part of the school planning process.

The Impact of Information Technology

Chapter 5 by Kaname Yanagisawa discusses the role of information technology as a major force in changing school design worldwide. This chapter offers a survey of the current state of learning and information technology in schools, analyzes trends in the response to this force – such as interdisciplinary learning, hands-on and self-learning, increased networking between school and community –, discusses the rationale for increased use of information technology, and provides suggestions for innovative school design from the viewpoint of IT application and individual learning, but also for prudent balancing of technology and providing spaces for actual face-to-face communication.

A Design Language for Learning Communities

In chapter 6, Jeffery A. Lackney presents his proposed design language. Effective communication between educators and architects is an essential prerequisite for the successful planning and design of schools, especially for those learning communities interested in challenging the boundaries of conventional models of educational practice. Educators lack a common language, a "lingua franca" for expressing their experience of the school as a place for learning and for articulating their environmental concerns with explicit reference to the activities of teaching and learning.

A common set of attributes of place experience, such as comfort, crowding, safety, ownership and personalization, and adaptability, has emerged in the environmental psychology literature across a broad range of place types. These attributes of place experience, when integrated into holistic design patterns, have the potential of creating a common language that both architects and educators can use to communicate and articulate their environmental experience with explicit reference to the purposes and activities of teaching and learning. This chapter introduces a number of patterns that have been found to be salient in school design, including "smaller is better," "the learning studio," and "school as three-dimensional textbook." These patterns represent the translation of research and best practice from a variety of sources within the educational, psychological and architectural literature. The common underlying premise is that all learning environments should be learner-centered, development- and age-appropriate, safe, comfortable, accessible, flexible, and equitable in addition to being cost effective.

1.1.4 Developing the Idea of "Schools for the Future"

How did we arrive at our idea of "schools for the future"? Some first indications were found in the internet platforms of Designing for the Future of Learning (www.design-share.com), the National Clearinghouse for Educational Facilities (www.edfacilities.org), and exchanges with international experts at conferences of the Environmental Design Research Association (EDRA), as well as a survey of experts in professional journals, who work with these topics on a daily basis in Germany, AIT (Architektur, Innenarchitektur und Technischer Ausbau [Architecture, Interior Design and Technical Construction]) and Baumeister [Master Builder]. In the second part of the study, we first described the facets that form the basis of the investigation (see chapter 7). Then we contacted architects we had found through various information channels to be experienced in school design, and interviewed them according to a structured interview guide of key questions pertinent to the topic of schools for the future. The goal of the interview was to identify innovative trends in school design and construction. We asked the architects not only for innovative criteria but also about positive and negative aspects in their work. (A brief description of the school examples is presented in chapters 4, 5, 6, and 7.2 and in the Appendix, which also shows photographs of these schools.) This also gave us some insight into obstacles to innovative building approaches. A summary table of these results can be found in section 7.2 on the systematic approach to judging the quality of schools of the future. Finally, we examined the aspects that must be mastered to arrive at a description of how schools for the future should be designed, according to our results, in chapter 8. In addition we repeatedly point out connections to innovative educational goals, and thus to lively instruction throughout the book.

1.1.5 Criteria For the Evaluation of School Buildings

Chapter 7 presents tools for the systematic judgment of school buildings according to the discussion in the previous chapters. The approach chosen is facet theory, a tool that offers help in structuring the large number of possible influences and makes it possible to organize the stimuli into environmental features with different variations, personal units (expert, user, passer-by), and subjective indicators or reactions (learning performance, expressions of well-being, social behavior).

Experiential reports are generated from interviews with experts and descriptions of innovative schools from 11 countries on five continents (see Appendix), and arranged in table format. A system for judging school quality (see Table 7.2) is developed, with the following criteria: functional, esthetic design, social-physical, ecological, organizational, and economical aspects, corresponding to common criteria in architectural practice. These criteria are applied to the following zones in the overall school complex: Outside spaces, school building, entrance, classrooms, specialty rooms, interiors and corridors, courtyard, and special areas. The interviews and descriptions are examined according to the criteria listed above. The results are then presented in tabular form and summarized in one final table.

The last section contains a review of the results. It lists critical considerations for all zones of a school complex and provides suggestions for future planning.

1.1.6 Conclusion: How Should Schools Be Built or Renovated? What Makes a School a "School of the Future"?

On the whole, the book takes the position that for schools of the future, user design (including appropriations), control of stress factors (climate control, window shade installation and adjustment, and the like) and control of communication (e.g., privacy, use of retreat opportunities) should be allowed to modify the original architectural design to flexibly accommodate future changing requirements. Such processes are psychologically determined mechanisms that facilitate innovation by user. They should not only be allowed but invited and encouraged by the architectural design. The fact that many users share the spaces certainly sets constraints for such adaptation. The goal should be to create a synergy of creative interaction between the initial provisions by the architectural design and the participatory contributions by children, parents, and teachers. Future user adaptations and modifications, beautification, personalization, and addition of public messages (which also counteract vandalism), generate a sense of ownership and responsibility for the architecture as a "mirror of the self in design."

The last part is an Appendix comprising a collection of drawings and photographs of the schools we analyzed.

Appendix: School Examples

The Appendix presents descriptions and photographs of 24 innovative schools from eleven different countries in five continents, including examples discussed in the preceding chapters:

USA

1. Rosa Parks Elementary School (Berkeley, CA, USA); Architects: Ratcliff Architects (Author: Henry Sanoff)
2. The Davidson Elementary School (Davidson, NC, USA); Architects: Adams Group Architects and Henry Sanoff AIA (Author: Henry Sanoff)
3. The School of Environmental Studies (Apple Valley, MN, USA); Architects: Bruce Jilk, H.G.A. Architects (Author: Kaname Yanagisawa)
4. Crosswinds Arts and Science Middle School (Woodbury, MN, USA); Architects: Cuningham Architects (Author: Kaname Yanagisawa)
5. Harbor City International School (Duluth, MN, USA); Architects: Randall Fielding, Scalzo Architects (Author: Jeffery A. Lackney)
6. Avalon School (St. Paul, MN, USA); Architects: Fielding Nair International (Author: Jeffery A. Lackney)
7. Millennium High School (New York, NY, USA); Architects: HLW Architects, Fielding Nair International (Author: Jeffery A. Lackney)

Asia

8. Akemi Minami Elementary School and Akemi Middle School (Urayasu, Chiba, Japan); Architects: INA, Planning Advisor: Kaname Yanagisawa (Author: Kaname Yanagisawa)

9. Gunma International Academy (Ohta, Gunma, Japan); Architects: CAt + CAn, Planning Advisors: Jun Ueno and Kaname Yanagisawa (Author: Kaname Yanagisawa) 10. Pathways World School (Gurgaon, New Delhi, India); Architects: C. P. Kukreja & Associates and Prakash Nair (Author: Jeffery A. Lackney)

Australia

11. Reece Community School (Reece, TAS, Australia); Architects: Glenn Smith Associates, Prakash Nair, and Tasmania Department of Education (Author: Jeffery A. Lackney)
12. Canning Vale High School (Perth, WA, Australia); Architects: Spowers Architects/VITETTA (Author: Jeffery A. Lackney)

Europe

13. Montessori College Oost (Amsterdam, The Netherlands); Architects: Herman Hertzberger, (Author: Kaname Yanagisawa)
14. Futurum Haboskolan (Balsta, Stockholm, Sweden); Architects: Jack Pattison (Author: Kaname Yanagisawa)
15. Fredrika Bremer Gymnasiet Förslag (Upper Secondary School) (Haninge, Sweden); Architects: Kristian Lindgren Arkitektkontor AB (Author: Kaname Yanagisawa)
16. Torpparinmaen School (Kaupunki, Helsinki, Finland); Architects: Seppo Hakli (Author: Kaname Yanagisawa)
17. Great Binfields Primary School (Basingstoke, Hampshire, UK); Architects: Hampshire County Council (Author: Kaname Yanagisawa)
18. The Classroom of the Future at Meadlands Primary School, Grey Court Secondary School, and Strathmore School (Richmond upon Thames, Hampshire, UK); Architects: Future Systems (Author: Kaname Yanagisawa)
19. Comprehensive School Brühl-South (Brühl, Germany); Architect: Peter Busmann (Author: Rotraut Walden)
20. Protestant Comprehensive School (Gelsenkirchen, Germany); Architect: Peter Hübner (Author: Rotraut Walden)
21. Martin Luther High School and Elementary School (Wittenberg, Germany); Refurbishment by Friedensreich Hundertwasser (Author: Simone Schalz)
22. Justus-von-Liebig-Schule (Moers, Germany); built by plus+ bauplanung; Architects: Prof. Peter Hübner; plus+bauplanung GmbH; Hübner-Forster-Hübner-Remes; Free Architects (Author: Claudia Corell, Principal); Photographs by Cornelia Suhan and Prof. Peter Hübner.

Africa

23. Manarah School Compound (Cairo, Egypt); Architects: Educational Projects Co., Dar Al Omran (Author: Jeffery A. Lackney)
24. Harare International School (Harare, Zimbabwe); Architects: Pearce McComish (Author: Jeffery A. Lackney)

1.2 Questions

When we retrospectively considered the schools we ourselves had come to know, we asked ourselves whether these school really improved the well-being of students and teachers: Do the children really identify with their school house? Are the teachers pleased with the appearance and livability when they enter? Do the children accept this building, where they are taught every day, as their own?

The influence of appearance and spatial composition of a school complex on the readiness to learn and on learning performance has been confirmed by numerous empirical studies (see Rittelmeyer, 1994, 1996, 1997, 2000, 2007, 2013). A first study by Rittelmeyer addressed the issue of an "esthetic school profile," including a look at Rudolf Steiner and the Waldorf schools.

In a seminar at Koblenz University we looked at the impact of buildings on learning and work in office environments. What are "intelligent" buildings and users? It was easy to transfer those insights to our topic of school buildings, as well as to make connections to the topics of dwelling and dwelling satisfaction/satisfaction with living spaces (Walden, 1993, 1995, 1996). And now we approach facets of architectural psychology from different directions. (Dieckmann et al., 1998; Hellbrück & Fischer, 1999; Kaminski, 1976). The books Kinder Räume. Kindertagesstätten aus architekturpsychologischer Sicht [Places for Children – Kindergarten from the point of view of architectural psychology] (Walden & Schmitz, 1999) and Schulen der Zukunft (Walden & Borrelbach, 2012) investigate the effect of buildings on children. Especially the latter book increased our interest in the topic of school buildings and led us to devote ourselves to this new book, together with international experts and architecture professors. Just how should innovative schools be designed, from educational and psychological points of view, as well as from that of architects, across all social, cultural, and climatic differences? This was the basic question with which we approached the topic.

Our book did not evolve without discussions about fundamental issues which the book can only touch upon. The following questions emerged as especially significant:

The opinions of interviewed architects should be complemented with the views of users (students, teachers, parents, community at large), as the book itself stresses time and again. Renewed attempts should be made to arrive at statements about causal relationships. Various studies by Walden (2006, 2007), in which empirical surveys of teachers and students were carried out, could not achieve causal analyses but only cautious, tentative conclusions. This is a general problem with psychological studies: The better the ecological validity, the more difficult it is to justify claims about law-like regularities. Walden's studies identified up to 337 variables and attempted to pinpoint the effects of architecture on performance, well-being, and environmental control. The question remains: Which building features can be recommended, with greater certainty, as means to improving teaching and learning processes, user well-being, a meaningful education overall? In this, interviewing architects and users is only a very first step. Such opinions are, after all, too often merely expressions of fads and beliefs in myths. But as Ingwer Borg proclaimed (in a workshop presentation at the ESADE Business School EU Work-climate – 1st European Industrial Relations Forum, Barcelona, Spain, November 10, 2005): "The Importance of Consistency: What You Say is What You Do?"

Likewise, the improvement of the research instruments used, specifically the system to judge the quality of school buildings developed in chapter 7, remains a constant research challenge. For example, it would be desirable to achieve a better conceptual distinction between aspects that apply to all environmental levels across the board and those that apply to one specific level only; or between aspects representing valid intrinsic cross-cultural causal relationships and those expressing mere temporary popular opinions among the interviewed subjects. The goal of identifying law-like connections between built environment and education still appears unattainable with current methods. Stern enforcement of discipline, or frontal lecture-style teaching – which is now being replaced by team-teaching, learning in groups, station learning, and open instruction – were once considered unquestioned appropriate teaching methods for lexical learning. This demonstrates that popular opinions must be critically examined, as well as the conclusion, from a psychological point of view, that spatial arrangements must be selected according to the personalities and preferred activities.

Similarly, the "trend" toward participation, which is eminently desirable from a psychological perspective, encounters its boundaries where it merely consists in shifting responsibility for important decisions onto the participants. It is as irresponsible to substitute participation for well-founded expert knowledge as the often customary and arrogant substitution of expert "authority" opinion for valid answers the expert does not have. In this book, we try to let experts speak who themselves ask users (which is what Henry Sanoff and Peter Hübner are practicing; see Walden 2007).

In his 2007 book Peter Hübner: Architecture as Social Process, Peter Blundell Jones describes the eminent role of Peter Hübner in Germany as an architect who understands how to utilize the social process of communication and interaction in participation between architect, students, teachers, and parents. Another pioneer of participatory approaches, the architect Henry Sanoff, is a contributor to this present book (see chapter 4).

Walter Kroner's Architektur für Kinder [Architecture for Children] (1994) is an eminent work that describes the opinions of children, educators, parents, and architects with regard to 30 different architectural projects for children. Krohner describes the aim of his book to be a planning advocate on behalf of children, together with the reader, in particular as they are often not in a position or able to articulate their own concerns. The buildings he discusses include kindergarten and day care centers, schools, housing, and a play tower in several countries.

Two other important books about school and kindergarten architecture were written by Mark Dudek: Architecture of Schools: The New Learning Environments (2000) and Schools and Kindergartens: A Design Manual (2007). They contain case studies, mostly from Europe, that are valuable for architects. In contrast to these works, our book emphasizes the identification of generally valid criteria founded on psychology that pertain to the connection between school buildings and the experience and behavior of students and teachers. Our book also recommends that existing norms and regulations be revised and amended using psychologically based knowledge – especially psychological but also educational and architectural criteria to judge the quality of school architecture (chapter 7) – and provides suggestions for the future planning of schools (chapter 6).

Thus, our intentions are somewhat different from those of other current books on school design. Our aim is to summarize internationally valid guidelines for future school buildings with a psychological foundation. This goal led us to the joint research project "Schools for the Future."

1.3 Significance of the Topic

"But we have known for decades from the psychology of learning and work that sustained readiness to perform can only be expected to grow in a stimulating environment that is somehow felt to be appealing to people" (Dreier et al., 1999, p. 22). This feeling of well-being in spaces is consistently mentioned in the literature and in surveys. The guidelines for quality living (dwelling) state: "Appreciation of positive feelings such as comfort, satisfaction, well-being served as the criterion for the success of interventions in many applied psychology studies (Walden, 1993, p. 64).

Spaces in school buildings and courtyards are places intended to be occupied by their users for considerable time. Much of childhood and adolescence is spent in these places. This raises demands for wideranging functional adequacy, for spatial and atmospheric quality. We remember, for example, student newspapers focussing on schools as learning and living environments and evaluating them with scaled judgments such as appealing, lively or deterring, inviting, hospitable or cold, cosy, comprehensible, livable, pleasant, comfortable, attractive, exemplary, friendly or boring, unlovable, desolate, gray.

Whether people are bored or feel stimulated depends on the kind of information they receive; specifically, on its degree of newness and complexity (Flade, 1987, p. 38; see 2006). Colors can produce interesting results: Light colors make interiors appear larger and lead to alertness and joy of working. Red, orange, and yellow are stimulating, and poorly lit spaces lack a stimulating quality. The degree of complexity of a living environment depends on the number of relevant elements and features. A simple architecture and style are perceived as monotonous and boring. Uniform, symmetrical, and parallel building wings and hallways produce monotony.

„Learning factories" built during the 1970s suffer from these shortcomings just as much as many urban schools dating from the 1920s. Children don't like these schools; they want splashes of color, wall paintings, visual angles. "Planners, architects and other building professionals often draw on their expert knowledge (usually acquired through their formal training and professional experience) and are guided by architectural esthetic imagery." (Wohnen, PZ Information 9/98, pp. 27–30) This is insufficient for school design and does not produce adequate impulse for the "school for the future." The architect must respond to the following demands:

- Schools must be places for learning and living
- Schools lead to sensory experience
- Schools are spaces for action-oriented activities
- Schools offer individual variety and team processes
- Schools facilitate social learning
- Schools are places for encounter
- Schools are a part of life
- Schools are a part of democracy
- Schools contain both privacy and public life
- Schools as models of building, livability, esthetics, technology, economics, sustainability.

The warning that such schools would exceed the limits of economic feasibility seems somewhat rash. What is needed is creativity, courageous ideas, educational daring, and responsiveness to student needs. These needs will necessitate changes in many schools that have been around for decades:

> *"It began with the slogan 'Tear down the walls.' In her school, principal Enja Riegel had the walls between classroom and hallway removed for every fourth classroom – without replacement. In these spaces that are now open to the hallways, the students have installed their meeting places. Here, they arrange exhibits and present their projects. During class, small groups can retreat into these often nicely decorated niches for separate quiet work."*
>
> (GEO Wissen Nr. 3/1999, p. 28).

This report demonstrates how the previous rigor and monotony has been dissolved, the students have been led to communicate, and even teachers now stop for small talk, are approached, and make joint plans. One thing worth mentioning: Now the students clean their school themselves, and the annual savings of 25,000 EUR make it possible to appoint a typesetter, a theater director, and an actor, to enrich the offerings of project groups and introduce other positive aspects into school life. Many students want to come back in the afternoon or evening to finish work they started earlier, or refine passages of their stage play. Architect Peter Hübner (Comprehensive School Gelsenkirchen) put this to the excellent point: "A building with key privileges for children" (personal communication, August 25, 1999).

„Schools for the future" don't necessarily have to be new buildings. They may just as well be existing buildings that have been adapted to new ways, that are opened up for contemporary instruction. Spatial experience, atmosphere, the articulation of the building with different levels and niches, easy orientation and access inside and out, their own unmistakable special touch are of prime importance.

Who creates the "school of the future"? Are architects the pioneers in this? Or are educators pressing for change? Does the building offer the possibility of realizing contemporary instructional approaches?

The "school of the future" will be easiest to achieve where all parties work together in a dynamic and complementary fashion. Student needs provide the guideline: The student personality on its learning path will remain the focus, with instructional participation, the demand for support and development, for personal gain and for togetherness. In future, we have to assume that the class unit will be broken up more frequently in favor of increased differentiation in teams and study groups. This in turn requires that the spatial structure must be variable and flexible.

Christian Rittelmeyer emphasized in a personal message "the necessity of planning schools according to educational considerations and less according to architectural fashions (such as glass and steel structures that often feel cold and impersonal)". From this point of view, he considers a permanent dissolution of the class unit as not very meaningful. "This would destroy the social relationships that only the class community makes possible. But that community needs a "home," a classroom as a familiar and comfortable environment (Rittelmeyer, 2007).

Peter Struck states this, in present tense that we can transform into the future, as follows:

> *"In new urban neighborhoods, schools are built as communication centers; they offer an all-day program and are expanded with a youth center, a kindergarten, a local library, sports facilities, an adult education center, and education and drug counseling facilities. They are the social-educational center of a community activity which can ultimately only function if teachers are prepared to engage in a manner that that goes far beyond giving lessons."*
>
> (Struck, 1992, p. 150).

It becomes clear that students or young people will spend more of their free time, their weekends and even vacation in the school facilities, in addition to the regular school program. Self-guided learning, self-determined activities coordinated in the circle of friends, the formation of teams promote social togetherness and stimulate interest, talent, and joyful creativity. The motto must be to acknowledge these trends.

Measures of Performance for the Success of Schools

In measuring the success of schools, the goals of the educators and their criteria must be considered. Following Duke and Trautvetter (2001, expanded criteria) such goals might include:

1. Reducing vandalism, the presence of drug dealers, theft, and violence through the possibility of better supervision of students in a building with easy overview.
2. Improving health and reducing absenteeism for health reasons through noise reduction, tangibly environment-friendly materials, greenery, and natural light.

3. Better motivation for learning and work through aspects that promote well-being, since there is a connection between well-being and performance (see Gifford, 2002).
4. Improving student performance as manifested in grades and test results.
5. Increasing graduation rates, the number of pupils successfully completing their schooling.
6. Increasing creativity, for example by means of appropriate rooms for artistic activities and reading corners.
7. Improving facilities for specialty subjects and projects.
8. Reducing the frequency of behavioral and attention problems – e.g., by means of smaller classes and schools
9. Improving cooperation between students, teachers, and parents through relief from "school stress" (see also point 8)
10. Motivating teachers to take an interest in special concerns of groups of students.

The school environment should contribute to the success of schools and to the goal of achieving the "school of the future."

1.4 Schools Claiming to Be "Schools of the Future"

Considering the "model" school buildings we chose to study for this project, we are tempted to say that we would almost wish to relive our own school days in such a school. All the schools we visited were astonishing. But we also realized that a pleasant school does not have to be extravagantly expensive (see Rhein-Zeitung, May 25, 2001). More often than not, the students' own improvements and decoration were the most appealing features that created a comfortable and livable atmosphere. The classrooms did not look like learning spaces but rather like individualized, comfortable living rooms. Especially for the classrooms, it is not solely the architect's task to create a good atmosphere, but also the responsibility of students and teachers. Participation is needed – a word that many people never heard in their own school days.

Peter Hübner calculated that his very livable and creativity-stimulating schools cost about 10–20% less, on average, than conventional schools. Modern communication and building technology in schools (e.g., climate control) tend to require frequent renovation, which makes such schools expensive. But investing in children is investing in the future of society.

1.5 The Architect's Leadership Role

If the learning and living space of a school is to have the desired depth and effect, the architect will have to begin with a floor plan that exhibits innovative contours. A rigid arrangement consisting of undifferentiated blocks and unimaginative rectilinearity may be economical and even functional in terms of structural and spatial efficiency, but not in terms of educational adequacy. Schools must offer spaces for the evolution of action-oriented processes and facilitate social learning. To learn, students need appealing, stimulating and esthetically pleasing spaces, niches, opportunities for retreat and space for movement. These needs must be given due consideration, and they are subject to change corresponding to the students' personality development towards independent action and engagement in team activity. Because children spend many years in these buildings, living, working, celebrating, and experiencing community, it is not unreasonable to suspect that this experiential place will "rub off" on personal impressions and moods. Young people search for models for their current and future lives. This gives the architect his leadership role and responsibility.

References

Blundell Jones, P. (2007). Peter Hübner: Architecture as social process. Stuttgart: Edition Axel Menges.

Dieckmann, F., Flade, A., Schuemer, R., Ströhlein, G., & Walden, R. (1998). Psychologie und gebaute Umwelt: Konzepte, Methoden, Anwendungsbeispiele. [Psychology and the built environment: Concepts, methods, application examples]. Darmstadt: Institut Wohnen und Umwelt.

Dudek, M. (2000). Architecture of schools. The new learning environments. Oxford: Architectural Press.

Dudek, M. (2007). Schools and Kindergartens: A design manual. Basel: Birkhäuser.

Duke, D.L., & Trautvetter, S. (2001). Reducing the negative effects of large schools. Washington, DC: National Clearinghouse for Educational Facilities.

Flade, A. (2006). Wohnen psychologisch betrachtet [Dwelling from a psychological point of view] (2nd rev. ed.). Bern: Huber.

GEO Wissen: Denken, Lernen, Schule. (1999, Nr. 3, pp. 26–35).

Gifford, R. (2002). Educational Environmental Psychology. In: Environmental Psychology: Principles and Practice (3rd ed., pp. 296–336). Colville WA: Optimal Environments.

Hellbrück, J., & Fischer, M. (1999). Umweltpsychologie. Ein Lehrbuch. [Environmental Psychology: A textbook]. Göttingen: Hogrefe.

Herrmann, A.G. (2001, May 25). Die Wohlfühl-Schule muss nicht teuer sein. Schule der Zukunft: Uni-Psychologen untersuchten Verhältnis von Architektur und Wohlempfinden. [The feel-good school does not have to be expensive: University psychologists investigate the relationship between architecture and well-being]. Rhein-Zeitung.

Kaminski, G. (2004). Hoffnung und Skepsis in den Beziehungen zwischen Psychologen und Umweltgestaltern. [Hope and skepticism in the relationship between psychologists and environmental designers]. Unpublished, revised manuscript of a June 2, 1988 lecture at the Institute for Interior Design at the Technical University Berlin (Institut für Ausbau und Innenraumplanung der Technischen Universität Berlin).

Kaminski, G. (Ed.). (1976). Umweltpsychologie. [Environmental Psychology]. Stuttgart: Klett-Cotta.

Lewin, K. (1963) Feldtheorie in den Sozialwissenschaften. [Field theory in the social sciences]. Bern: Huber.

Linneweber, V. (1996). Lernumwelt: Schule. [Learning environment: School]. In L. Kruse, C.F. Graumann, & E.D. Lantermann (Eds.), Ökologische Psychologie [Ecological Psychology] (pp. 383–388). München: Psychologie Verlags Union.

Moore, G.T., Tuttle, D.P., & Howell, S.C. (1985). Environmental design research directions: Process and prospects. New York: Praeger.

Rittelmeyer, C. (1994). Schulbauten positiv gestalten: Wie Schüler Farben und Formen erleben. [Creating positive school buildings: How students experience color and form]. Wiesbaden: Bauverlag.

Rittelmeyer, C. (1996). Wie wirken Schulbauten auf Kinder? [How do school buildings affect children?]. Erziehungskunst, 60, 739–735.

Rittelmeyer, C. (1997). Schularchitektur. Wie Schulbauten auf Schüler wirken. [School architecture: How school buildings affect children]. Die Ganztagsschule, 37, 29–40.

Rittelmeyer, C. (2000). Schularchitektur aus Schülersicht. Kinderleben. [School architecture from the students' point of view. Children's life]. Zeitschrift für Jenaplan-Pädagogik, Nr. 12, 13–16.

Rittelmeyer, C. (2007). Schule als gestalteter Raum: Schularchitektur. [School as designed space: School architecture]. In: S. Hellekamps, W. Wittenbruch, & W. Plöger (Eds.), Handbuch Schule. [School Handbook]. Paderborn: Schöningh.

Rittelmeyer, C. (2013). Einführung in die Gestaltung von Schulbauten. [Introduction into the design of school buildings]. Frammersbach: Verlag Farbe und Gesundheit.

Struck, P. (1992). Schul- und Erziehungsnot in Deutschland: Ein Ratgeber für Eltern, Lehrer und Bildungspolitiker. [School and education crisis in Germany: A guide for parents, teachers and education politicians]. Neuwied: Luchterhand.

Walden, R., & Borrelbach, S. (2012). Schulen der Zukunft. Gestaltungsvorschläge der Architekturpsychologie. [Schools of the future: Design proposals from architectural psychology] (7th ed.). Heidelberg: Asanger.

Walden, R., & Schmitz, I. (1999). KinderRäume: Kindertagesstätten aus architekturpsychologischer Sicht. [Spaces for children: Kindergarten buildings from the point of view of architectural psychology]. Freiburg im Breisgau: Lambertus.

Walden, R. (1993). Lebendiges Wohnen: Entwicklung psychologischer Leitlinien zur Wohnqualität. Aneignungshandlungen in Wohnumwelten aus der Sicht von Architekten, Bewohnerinnen und Bewohnern [Lively Living: Developing psychological guidelines for quality of living. Interior design and living environments from the perspective of architects and inhabitants). Frankfurt am Main: Peter Lang.

Walden, R. (1995a). Wohnung und Wohnumgebung. [Living space and living environment] In: A.G. Keul (Ed.), Wohlbefinden in der Stadt: Umwelt- und gesundheitspsychologische Perspektiven [Well-being in the city: Environmental and health-psychological perspectives] (pp. 69–98). Weinheim: Beltz-PVU.

Walden, R. (1995b). Lärm und Ruhe in ihrer Bedeutung für Wohnqualität. [Noise and silence: Their relevance for quality of living]. Zeitschrift für Lärmbekämpfung, 42, 159–168.

Walden, R. (1996a). Die Selbstverantwortung von Bewohnern: Eine Grundlage zur sichtbaren Stabilisierung von Lebensverhältnissen. [Self-determination of residents: A basis for the visible improvement of living conditions]. Die Wohnungswirtschaft, 49, 40–44.

Walden, R. (1996b). Wohlbefinden und Wohnzufriedenheit. Bauen für die Seele. [Well-being and satisfaction with living conditions. Building for the soul). Heraklith Rundschau, 26–27.

Walden, R. (2006). Zu den Auswirkungen von Architektur auf Leistung, Wohlbefinden und Umweltkontrolle. Drei Studien zur Schule, Hochschule und zum Bürogebäude "der Zukunft". [On the effects of architecture on performance, well-being, and environmental control. Three studies of schools, universities, and office buildings "of the future"]. Unpublished professorial dissertation, University Koblenz-Landau, Germany.

Walden, R. (2008). Architekturpsychologie: Schule, Hochschule und Bürogebäude der Zukunft. [Architectural psychology: School, university, and office buildings of the future]. Lengerich: Pabst Science Publishers.

Werner, C.M., & Altman, I. (2000). Humans and nature: Insights from a transactional view. In S. Wapner, J. Demick, T. Yamamoto, & H. Minami (Eds.), Theoretical perspectives in environment-behavior research. Underlying assumptions, research problems, and methodologies. New York: Kluwer.

Wohnen. (Dwelling) (1998). PZ Information 9/98: Sozialpädagogik: 9. Klasse, 2. Halbjahr [Social pedagogics: 9th grade, 2nd half]. Bad Kreuznach: PZ. (Pädagogisches Zentrum Rheinland-Pfalz).

2.1 History of the Schoolhouse in the USA

Jeffery A. Lackney

2.1.1 Introduction

The history of the American schoolhouse reflects the history of education that in turn mirrors a plethora of contextual societal forces including social, economic, and political ones. The architectural form and layout of the school building has historically been influenced by the evolution of educational philosophy and goals, curricular objectives, instructional methods, and cultural values of schools. For example, the architecture of the small one-room country school building was an appropriate design response that served the basic educational and social needs of small rural communities for well over 200 years in the United States. As the social problems associated with the rise of the Industrial Revolution increased in the mid and late 19th century, the need for educating larger groups of immigrants in urban centers became central. Large multistoried classroom buildings provided the necessary educational and architectural response at that time to the common school movement. After World War II, societal changes created by the baby boom created an enormous demand for school construction. New methods of school building construction allowed for further experimentation in flexible and adaptable space for education. Innovations in educational delivery such as the Progressive Movement, lead principally by John Dewey (1859–1952), required school architecture to respond yet again with more child-scaled, flexible, and open environmental settings.

The general acceptance of various innovations and paradigms in educational design usually occurred several years following a specific innovation, and not without some social and political resistance. Many Colonialists did not see the need for a separate schoolhouse when they could teach their own children at home, since the objective was to learn how to read the Bible or be apprenticed in the family trade. The Progressive Movement in education beginning in the late 19th century did not significantly influence education or school architecture until the middle of the 20th century, and school design today still responds to outdated modes of instruction.

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This chapter presents a history of educational architecture that follows three general periods of American social, economic, and political history: the agrarian Colonial period (1650–1849), the Industrial Revolution (1850–1949), and the so-called Information Age (1950–present). The focus is on general trends in education as they relate to educational architecture. Looking at the architectural design of schools provides us with an opportunity to infer what may actually have happened in the classroom and reveal the essence of the pedagogy that has influenced educational practice (McClintock & McClintock, 1970).

2.1.2 Educational Architecture in the Colonial Period

Early American society consisted of village settlements where land was cultivated for agricultural purposes. The economy was decentralized and locally based. Politically, the village was typically under the control of a single authoritarian or a small group of social elite. Community life was organized around the social support of the village settlement pattern of semi-isolated communities. Houses were grouped around a central public meeting space containing public structures such as the church, a meeting hall, and a school.

Agricultural life required the family structure to be multigenerational and extended. Work life and home life were intermingled. The imperative of group survival required an individual's personal needs to come second to those of the group. People rarely left the confines of their own village. When they did, they were limited to walking or traveling on horse and wagon, or sometimes by boat.

Education during this period was informed by and focused on survival needs. The most informal process occurred in the farm families where children needed to contribute labor in order for the family to survive. The necessary skills and knowledge were learned from parents and older siblings as the child participated in the work of the family. Through apprenticeships, craftsmen and tradesmen would pass on their skills and knowledge to the next generation.

When English settlers arrived in New England, they quickly established Latin grammar schools and colleges (Herbst, 1996). The most formal structure involved the academy and university. Harvard College was established in 1636, while William and Mary followed in 1688. These opportunities were reserved for the elite and to some degree perpetuated the survival of the elite in the classicist society. State-mandated public education did not exist prior to the 19th century, but rather was run by parents and trustees (DeYoung, 1989).

The need for literacy in the village focused almost entirely on exposure of Christian morality and the teaching of the Bible. The Old Deluder Satan Act of

1635, a Massachusetts law, was the first educational legislation in the United States, requiring parents to teach their children how to read the Bible. The Sunday school movement in the early 19th century was one of several precursors to the common school (DeYoung, 1989). In the New England colonies, the first schools were set up in either private homes or churches (Graves, 1993). One form of informal school was the originally English institution known as the “dame school” (Johnson, 1963). Unmarried or widowed older women often held classes in their own homes, while wealthy parents hired tutors to come into the home to instruct their sons in the classics, i.e., texts written in the ancient Mediterranean world. In 1647, the government of Massachusetts Bay enacted the first statute in America providing for the establishment of a school system requiring for the provision for building school buildings (Gulliford, 1984).

Figure 1. Bear Creek School (c. 1870), Iowa. (Iowa State Historical Society; Courtesy and permission of author Andrew Guildford (1984). America’s Country Schools. National Trust for Historic Preservation.)

The One-Room Country Schoolhouse

The typical educational facility of the Colonial period was the so-called one-room schoolhouse (see Figure 1). This school was multi-aged by necessity, due to the size of the village community, with the teacher presiding over instruction, emphasizing recitation and direct supervision. One-room schools often had very simple furnishings, poor ventilation, and relied on oil lamps for light and wood burning stoves for heat. Schoolhouses in urban areas were variations on the theme of the country schoolhouse often containing two, four, or six self-contained rooms, often with their own entrances. Many of these larger structures housed a short-lived educational movement called the Lancasterian schools (Graves, 1993).

The school was a main social center of community where town meetings, voting, fund raisers and celebrations took place. The school integrated people into their community and provided an identity that continues to influence school design (Gulliford, 1984).

At the beginning of the 20th century, in response to urbanization, the process of school consolidation created much resistance in rural communities where the symbol of the one-room schoolhouse was the focus of rural life. According to Andrew Gulliford, by 1913, half of the schoolchildren in the United States were enrolled in the country's 212,000 one-room schools (Gulliford, 1984). By the end of the 20th century, less than 0.5% of all public school buildings in operation were one-room schools (Gulliford, 1996).

2.1.3 Educational Architecture of the Industrial Revolution

The Industrial Revolution was fueled not only by the integration of the market economy, but also by the advancement in the technology of mechanization as well as the rise of the corporation. As production shifted and accelerated from the farm to the factory, higher levels of interdependency required collective efforts, highly specialized division of labor, coordination and integration of many different skills; from unskilled workers to an industrial caste system of technicians, secretaries, and clerks. Likewise, in the public sector, an abrupt shift was seen from autocracies and monarchies to highly centralized, hierarchical bureaucracies based outwardly on representative democracy but influenced by powerfully organized special interest groups.

As populations shifted from rural to urban, from village to city, urban life provided a forum for balancing private interests against public good. Urbanity also created a powerful school of social learning, and created a common ground for meeting strangers while at the same time creating alienation and casting doubt on values long experienced in the village. Due to economic and social pressures, smaller family structures began to replace the extended family. As health standards increased and the need for extra farm hands decreased, procreation needs decreased. Work was now taking place in other settings creating a work/home split. The rise of social institutions to standardize and centralize the care of the population segregated the entire society: the young in schools, the elderly in nursing homes, the sick in hospitals, the social deviants in prisons, and the workers in offices and factories.

The Common School Movement

The common school movement took hold in America's cities starting in the 1840s. Educational reformers argued that rural community education was insufficient in America's industrial and urban areas where poor rural and immigrant children were grouped together. Horace Mann (1796–1859), Henry Barnard (1811–1900) and other educational reformers argued that public schooling was essential for the economic possibilities of both the individual and the nation (DeYoung, 1989).

The common school movement, supported by local property tax, gave rise to the public education system as a result of popularizing the principle of free schooling (Herbst, 1996). Schools became highly formalized and hierarchically designed to sort students who were eligible for promotion to a higher level in the system from those who were not. At this time, agrarian immigration from Ireland and Southern Europe created a new demand for Catholic schools and the formation of a private Catholic school system as an alternative to the Protestant public school system that continues to this day.

It is customary to class Henry Barnard (the first United States Commissioner of Education), along with Horace Mann, as one of the great reformers of antebellum public schooling. With the publication of his book entitled School architecture, or contributions to the improvement of schoolhouses in the United States in 1838, Barnard is credited with raising the standards of school buildings serving the common school movement (Barnard, 1838, cited in McClintock & McClintock, 1970). Barnard is credited with defining the character of school architecture in the United States by integrating the concerns of architecture with pedagogy. He emphasized school "architecture" over school "building" by suggesting that the architect is ultimately concerned with the cultural, spiritual, and humane value of his work, while the builder is primarily concerned with its physical structure, reasonable cost, and the service of function (McClintock & McClintock, 1970).

Starting in the mid 19th century, urban schools could be found on tight sites of less than a quarter acre with no landscaping. Students were segregated by age into a graded organization. One hundred students might be housed in a single classroom. The classroom, other than corridor spaces, was often the only type of space in the school. The average class size may have been 50 or more students, with desks often bolted to floors in row and column arrangements.

Toward the end of the 19th century, school buildings began to be designed and constructed with other functional considerations. Golda Meir School in Milwaukee, designed in the Romanesque Revival style by architect H.C. Koch & Company, provides a classic example of these school designs (see Figure 2). Wide hallways were created to accommodate increased traffic flows, auditoriums

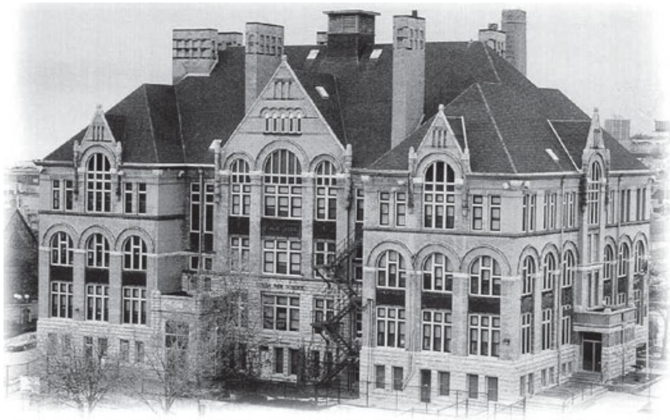

Figure 2. Golda Meir School (c. 1889). (Courtesy of Milwaukee Public Schools.)

were added to support large assemblies, and administrative offices appeared for the first time. Expanded offerings in art and science began the development of specialty classrooms. These are characteristics of the schoolhouse that have remained and expanded well into the 20th century.

Boston's Quincy Grammar School is an oft-cited example of early factory model design principles and a design replicated across the country throughout the 20th century. Built in 1848, Quincy Grammar School, the first graded public school in the United States (Graves, 1993) stood four stories high and housed 660 students with classrooms opening onto a common corridor. Each classroom housed 55 students in rooms measuring 9.4 m × 7.9 m (31 × 26 feet), a standard for self-contained classrooms many school districts still adhere to in their "modern" educational specifications. Each classroom had an attached closet. Individual desks, at the time an innovation in school design, were bolted to the floor, seven rows of them eight to a row. The top floor was a large assembly hall with benches to seat the entire student body, with the administrative office located on the first floor (Graves, 1993).

During the first quarter of the 20th century, as school populations grew due to urbanization, buildings designed to specialize in the housing of junior high school and high school educational programs were constructed, and many more types of auxiliary spaces were added. Auditoriums, laboratories, art studios, gymnasiums for physical education, and home arts spaces were routinely added to the educational building program.

In the 1890s, the National Council of Education of the National Education Association commissioned the Committee of Ten to define the nature and purpose of American secondary education (Herbst, 1996). Their report did not address the growing demand for nonacademic, manual or vocational education, believing that secondary institutions were feeders to college admission.

Advocates of vocational education quickly challenged the Committee of Ten recommendations and introduced public technical and industrial high schools, establishing new forms of schoolwork relationships through cooperation with industry (Herbst, 1996). By the turn of the 20th century, secondary education had become part of common schooling, giving rise to the development of the modern comprehensive high school (Herbst, 1996).

Another school organization invented in the early part of the 20th century, the junior high school, was created with the purpose of easing the transition from elementary school settings to the departmentalized high school settings, and solve the problem of general overcrowding in both elementary and high schools (Rieselbach, 1992).

The Progressive Movement

During the late 19th century, a progressive movement emerged in Europe as well as the United States as a general critique of the public educational system. A central principle of the progressive movement was the concept of child-centered education and the argument that the needs of the state, the church, or the economy should not take precedence in shaping child development (Saint, 1987). The Progressive movement is traced primarily to educators such as Friedrich Froebel (1782–1852) in Germany, Maria Montessori (1870–1952) in Italy, and John Dewey in the United States.

The objective of John Dewey's experimental school, called the Laboratory School, at the University of Chicago was to create a new curriculum in which developmental, intellectual, and social goals were integrated. Dewey developed the idea of the schoolhouse as a true home in which the activities of social and community life were expressed in the curriculum (see Figure 3).

2.1.4 Educational Architecture in the Information Age

The current Information Age is a period of American history representing a time of great cultural transformation from the industrial factory model to a new paradigm that is rapidly unfolding.

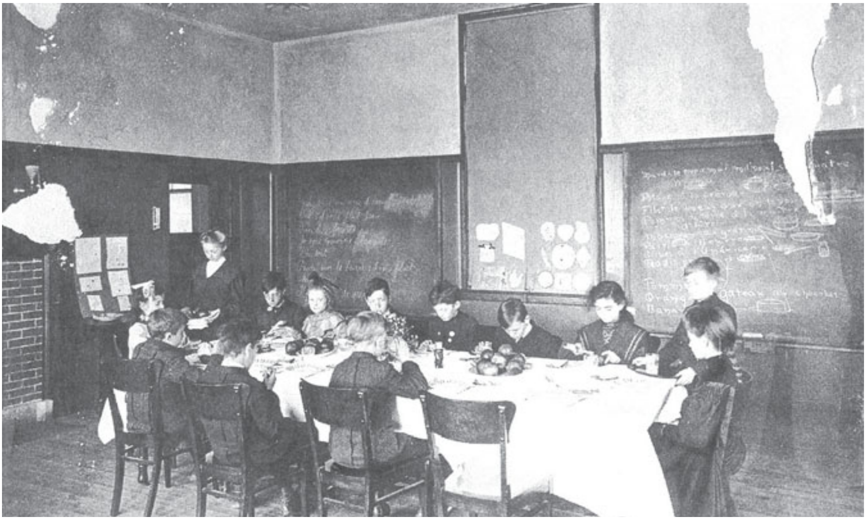

Figure 3. Students eat a gourmet lunch they planned and prepared in their French class. (Reprinted by permission of the publisher. From Laurel Tanner, Dewey's Laboratory School: Lessons for Today, New York: Teachers College Press, © 1997 by Teachers College, Columbia University. All rights reserved.)

Educational approaches to accommodate the Information Age have created much experimentation and controversy. The 1960s witnessed the most dramatic educational reform in America's history in both educational research and practice of curriculum and instruction. Open education, community education, and the community school concept, the middle school concept, and alternative and magnet schools have been explored and re-explored.

The Modern School Building

The Information Age has seen new innovations in educational architecture, although many school boards continue to miss opportunities to create better school facilities as they struggle to cope with ever increasing enrollments. Many schools were built too inexpensively, creating poorly insulated roofs and walls and poor-quality building systems (Brubaker, 1998). Like the building boom earlier in the century, the 1950s saw a proliferation of standardized plans that has characterized educational architecture of that period.

The school building that more than any other defines modern educational architecture in the United States is Crow Island School in Winnetka, IL, which

Figure 4. Crow Island School building entrance emphasized by a large vertical clock tower. (By Steven R. Turckes, AIA, LEED AP, REFP - Principal, Perkins + Will.)

opened in 1940 (see Figures 4, 5, and 6). It demonstrated a new kind of architecture for education. It is in stark contrast to the traditional multistory masonry buildings at the turn of the 20th century. The most significant contribution of the Crow Island School is the progressive and innovative educational program that it contains and supports to this day (Brubaker, 1998).

The school emphasizes child-scaled environments throughout the building, with classrooms designed to support a variety of learning activities and provide a sense of belonging. The classroom is designed in an "L«-shape that provides for an entrance foyer with storage and an adjacent bathroom, a separate kitchen project area and a main classroom space with exterior glass wall on two sides of the classroom and a door to a semi-enclosed outdoor classroom. Crow Island served as a model for many schools after World War II when the baby boom began and thousands of new schools were needed.

The Open Classroom

American educators' interest in the English "infant" (elementary) schools and their use of what the English called "informal education" lead to the open education movement of the mid-1960s. Informal education, the "integrated day," and other progressive ideas had evolved in England since the 1920s, influenced by

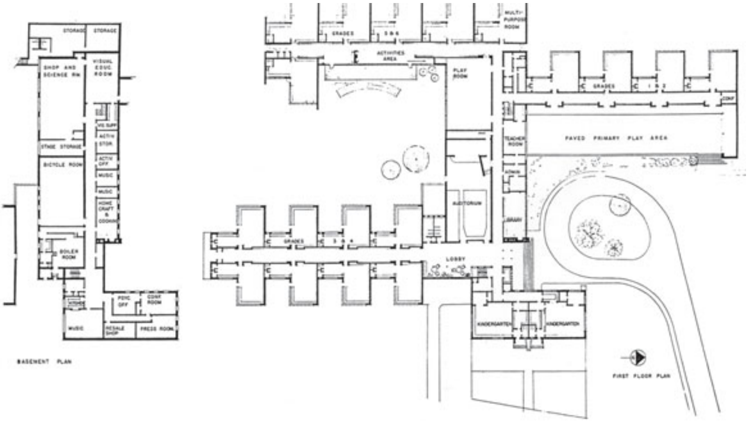

Figure 5. Crow Island School floor plan illustrating the classroom "finger plan" concept. (By Steven R. Turckes, AIA, LEED AP, REFP - Principal, Perkins + Will.)

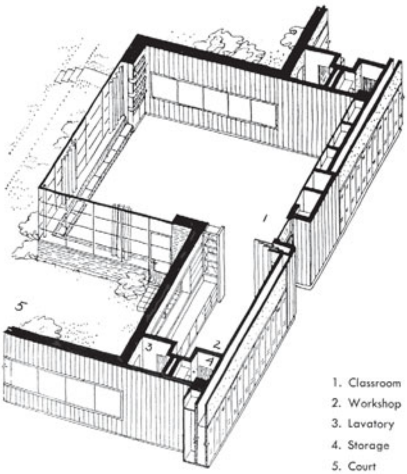

Figure 6. Crow Island School axonometric drawing illustrating a typical classroom pod that separates wet from dry spaces (2), windows on two sides of the classroom that provide high-quality natural daylight (1), and an exterior door to an outdoor court that serves as an outdoor classroom (5). (By Steven R. Turckes, AIA, LEED AP, REFP - Principal, Perkins + Will.)

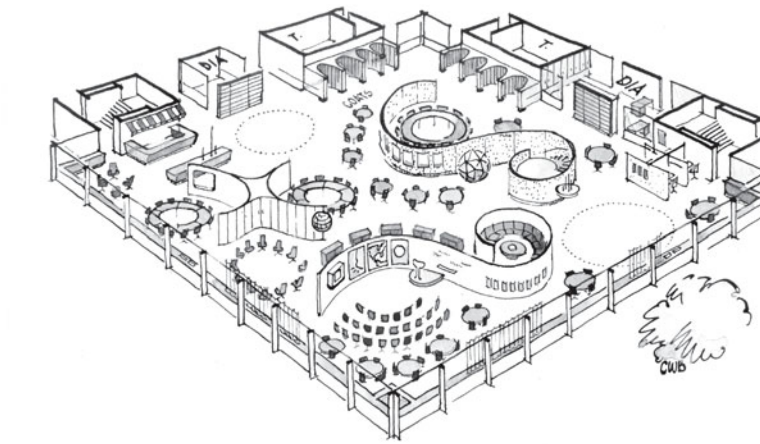

Figure 7. Disney School, an early idealized open-plan concept diagram by C. William Brubaker. (By Steven R. Turckes, AIA, LEED AP, REFP – Principal, Perkins + Will.)

group work methods of Froebel and Dewey, or child-sized, movable furniture advocated by the Montessori school (Saint, 1987) rather than inhibiting or distracting for the sake of some ideal architecture (Saint, 1987). During the war, many children were evacuated to the countryside to protect them from bombing raids. Schooling continued with students of all ages living with their teachers. After the war, faced with children of different ages and with different levels of academic achievement, educators developed an organization of teaching students of diverse achievement levels they believed was strengthened when different aspects of the curriculum were integrated and related to ongoing daily activities (Rothenberg, 1989).

During the 1960s, in the US, a radical critique of traditional education favored the teaching methods adopted from British informal education. Open education, it was argued, provided more educational opportunities for children, provided freedom and autonomy for self-directed study, required less guidance by the teacher, and helped foster self-responsibility. As a result, open education and its complementary physical counterpart, the open classroom, were quickly adapted (Barth, 1972).

One of the most influential innovations was the development of the "open plan" school design, a concept that influenced the design of thousands of schools from the late 1950s through the early 1970s (Marks, 2000). Created by The Educational Facility Laboratory, these schools were planned with large, open, flexible spaces adaptable to team teaching and small-group and individualized instruc-

Figure 8. Disney School, open classroom space.
(By Steven R. Turckes, AIA, LEED AP, REFP – Principal, Perkins + Will.)

tion that characterized open education. The Disney School in Chicago (c. 1960) designed by Perkins & Will Architects provides an example of the types of environments envisioned for open plan schools (see Figures 7 and 8).
Open plan schools, as they were called, began to fail as soon as they were occupied. Noise and visual distraction was the biggest complaint of educators. However, there were much deeper reasons for the failure. No adequate or systematic training for teaching professionals in the philosophy of open education was implemented, so teachers continued to teach applying traditional direct instruction methods. The root of the failure of open classroom design solution may have simply been the lack of proper funding support for open education (Ehrenkrantz, 1999).

The Middle School House Plan
In the 1960s, an alternative organization, the middle school, was developed as a critique of the junior high model. It was argued that the needs and interests of young adolescents were not being met due to adjustment problems caused by the abrupt change from a self-contained classroom environment to a departmentalized organization characterizing high schools (George & Alexander, 1993). Since 1960, over 15,000 middle schools have been instituted in the United States alone (George & Alexander, 1993) co-existing with junior high schools (grades 7–9) and other forms of intermediate schools.

The middle school was originally characterized by several grade structures (6–8, 5–8 or 7–8). The intent of the middle school movement was to advocate the concept of "a school in the middle," balancing the child-centered, supportive interpersonal structure of instruction of the elementary school with the subject-oriented teacher specialization of the high school (Carnegie, 1988).

Teachers in the middle school setting go beyond team teaching to form a small interdisciplinary team that shares the same group of students (100–120), block schedule, areas of the school building ("house" or "pod" plan), and the responsibility for planning the basic academic subjects (George & Alexander, 1993).

Pod-style and house-type middle school layouts have predominated. Pod plans were first developed in the 1960s, while the house plan has a more recent history, being most fully developed in the 1980s. Both layouts allow for the creation of families of students. The intent is to foster a sense of community – thus, the notion of a "house" for a "family" – while providing larger more common spaces to which the entire school has access: Libraries, media centers, administrative functions, gymnasiums, and special programs such as art, music, computer instruction, and language arts laboratories.

The house plan concept is currently being applied in some high school environments as an appropriate response to advances in self-directed learning and interdisciplinary instruction. The goal of keeping groupings of learners small enough to support individualized attention and cooperative learning is now seen as having developmental value throughout the K-12 learning experience.

Crosswinds Arts and Science Middle School provides a modern example of a 600-student grade 6–8 middle school concept (see Figure 9). The school was designed with multi-age learning houses, or "home bases," designed for 100 students each, of mixed grade levels. Each of the houses features lab and discovery space where students work alone or in small groups exploring subjects. Spaces were created to support hands-on, project-based learning. Home bases open onto a larger central area that contains an all-school performance area and social hall.

Smaller Learning Communities

In the 1990s, based on a growing consensus in the research literature, there was a rapidly growing interest in the construction of new smaller schools and the restructuring of older school buildings into schools-within-schools. Educational research indicates that participation in school activities, extracurricular activities, student satisfaction, social connectedness, achievement, number of classes taken, and community employment are all greater in small schools relative to large schools (Barker & Gump, 1964; Cotton, 1996), while disciplinary problems,

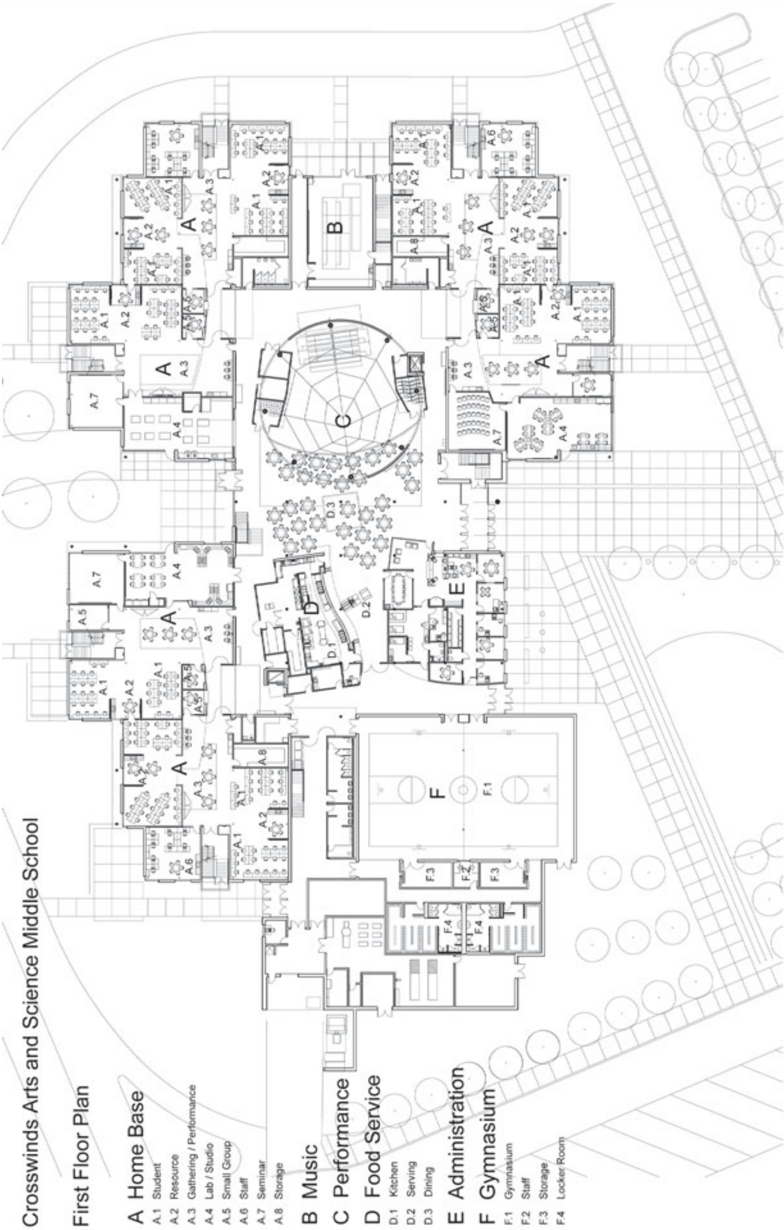

Figure 9. Crosswinds Arts and Science Middle School, multi-age plan concept. (Courtesy of Design Share, Inc.)

incidents of vandalism, truancy, drug use, and drop-out rates are lower (Fowler & Walberg, 1991).

New high school designs have begun to follow the middle school "house" plan for a "family" of students and teachers; 100–120 students and their teachers are grouped into a wing of the school that serves as what is now called a "neighborhood" plan for the "learning community." Several plans emerging to create these schools-within-schools within new and existing schools include vertical houses, ninth-grade houses, and special curriculum houses (McAndrews & Anderson, 2002).

Along with the reorganization of high schools, there are initiatives across the United States to train teachers in new instructional strategies such as problem-based learning, a recent trend in reforming traditional lecture-oriented, discipline-focused instruction (Costa & Liebmann, 1997).

School planners and architects have developed a variety of school designs that support personalized, self-directed learning, such as variable and flexible sized space, individual work spaces that can be personalized providing a sense of ownership and responsibility, teacher team spaces with adjacent material preparation areas and meeting space that encourages team teaching and collaboration. Functional spaces for collaborative learning may include presentation spaces, galleries, studios, access to technology, informal, non-classroom, learning spaces such as study spaces, lounges, and outdoor spaces to provide areas for socializing and serendipitous meetings that can foster creative thought and solutions to problems (Wolff, 2001)

Harbor City Charter School, in Duluth, MN, a high school with a total of 200 students, is one of a growing number of small learning environments that are the result of the small schools movement (see Figure 10). The school provides a small learner-directed community, encouraging investigative learning and global citizenship and nurtures a sense of belonging. Taking up only 1,300 m2 (14,000 square feet) of floor space in an existing warehouse building, the school is located within walking distance of the public library, YMCA, art museum, aquarium, and television station – allowing the school to leverage other facilities for learning. Collaboration and project-based learning were identified as key drivers of the design with the inclusion of a variety of large and small instructional spaces for both individual and group activity.

The Virtual School

According to the U.S. Department of Education Institute of Educational Sciences reports as of 2006, there are approximately 84,500 elementary and secondary schools in the United States. Many if not most of these schools serve populations

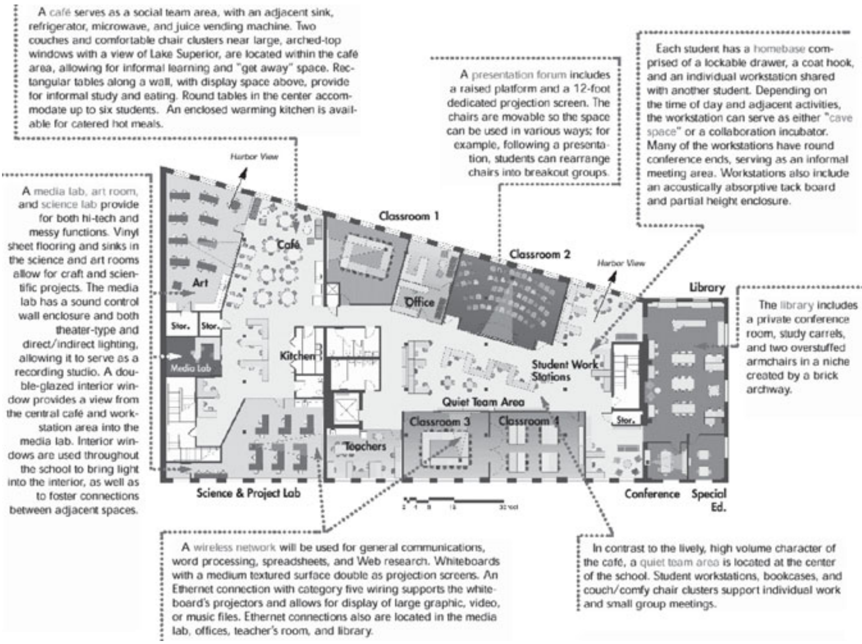

Figure 10. Annotated floor plan of Harbor City Charter School. (Courtesy of Randall Fielding.)

based on specific geographic areas of catchment. However, the idea of serving only a local population of students is breaking down with the further development of information and communication technology. The ability to gain access to the Internet has increased the ability of schools to go from offering a few distance learning programs on the margins to becoming completely "virtual," offering a wide range of educational programs via the Internet. As of the year 2000, at least six U.S. states have launched online virtual high schools that offer complete online courses to students in school or at home (Trotter, 2000). Theoretically, learning environments may be physically spaced across the entire community in libraries, businesses, community centers, and homes in addition to the traditional schoolhouse and temporally scheduled both synchronous and asynchronous through the Internet. With the rapid increase in the use of wireless Internet connections, the U.S. school of the near future may take on a design completely different from anything we have seen to date.

References

Barth, R. (1972). Open Education and the American School. New York: Agathon.

Barker, R.G., & Gump, P.V. (1964). Big school, small school. Palo Alto, CA: Stanford University Press.

Brubaker, C.W. (1998). Planning and designing schools. New York: McGraw-Hill.

Carnegie Foundation. (1988). An imperiled generation: Saving urban schools. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching.

Costa, A.L., & Liebmann, R.M. (Eds.). (1997). The process-centered school: Sustaining a renaissance community. Thousand Oaks, CA: Corwin.

Cotton, Kathleen (1996). Affective and Social Benefits of Small-Scale Schooling. (ERIC Document Reproduction Service EDO-RC-96-5).

DeYoung, A.J. (1989). Economics and American education: A historical and critical overview of the impact of economic theories on schooling in the United States. New York: Longman.

Ehrenkrantz, E. (1999, September). Planning for flexibility, not obsolescence. Keynote address presented at the UEF-21 Conference at the New Jersey Institute of Technology, Newark, NJ, September 17, 1999. Retrieved from http://www.designshare.com/Research/EEK/Ehrenkrantz1.htm

Fowler, W., & Walberg, H.J. (1991). School size, characteristics and outcomes. Educational Evaluation and Policy Analysis, 13, 189–202.

George, P.S., & Alexander, W.M. (1993). The exemplary middle school. Fort Worth, TX: Holt, Rinehart and Winston.

Graves, B. (1993). School ways: The planning and design of America's schools. New York: McGraw-Hill.

Gulliford, A. (1984). America's country schools. Washington, DC: Preservation Press.

Gulliford, A. (1996). America's country schools. (3rd ed.). Washington, DC: Preservation Press. Herbst, J. (1996). The once and future school: Three hundred and fifty years of American secondary education. New York: Routledge.

Johnson, C. (1963). Old-time schools and schoolbooks. (First published in 1904 by Macmillan). New York: Dover.

Lackney, J.A. (1994). Educational facilities: The impact and role of the physical environment of the school on teaching, learning and educational outcomes. Milwaukee, WI: Center for Architecture and Urban Planning Research, University of Wisconsin-Milwaukee.

Marks, J. (2000). The Educational Facilities Laboratories (EFL): A history. Washington DC: National Clearinghouse for Educational Facilities.

McAndrews, T., & Anderson, W. (2002). Schools within schools. ERIC Digest 154. College of Education, University of Oregon: Clearinghouse on Educational Management.

McClintock, J., & McClintock, R. (1970). Henry Barnard's school architecture. New York: Teachers College Press.

Meek, A. (Ed.). (1995). Designing places for learning. Alexandria, VA: Association for Supervision and Curriculum Development.

National Council on Schoolhouse Construction (NCSC). (1953). Guide for planning school plants. National Council on Schoolhouse Construction (now Council of Educational Facility Planners, International). Nashville, TN: Peabody College.

Rieselbach, A. (1992). "Building and Learning". In The Architectural League (Eds.), New schools for New York: Plans and precedents for small schools. New York: Princeton Architectural Press.

Rothenberg, J. (1989). The open classroom reconsidered. Elementary School Journal, 90, 69–86.

Saint, A. (1987). Towards a social architecture: The role of school building in post-War England. New Haven, CT: Yale University Press.

Tanner, L.N. (1997). Dewey's Laboratory School: Lessons for today. New York: Teachers College Press.

Trotter, A. (2000, October 25). States virtually carried away over online high schools. Education Week, 20(8), 22.

Wolff, S.J. (2001, September). Sustaining systems of relationships: The essence of the physical learning environment that supports and enhances collaborative, project-based learning at the community college level. Unpublished dissertation, School of Education, Oregon State University.

2.2 Historical Background of the Japanese School

Kaname Yanagisawa (Japan)

2.2.1 A Brief History of Japanese School Planning

There were no public schools in Japan before the Meiji era (1868–1912) other than private schools called "Hanko," which were feudal clan-owned schools established for educating samurai (warriors), and "Terakoya," temple-owned schools for educating tradesmen and farmers. In these schools, one teacher was responsible for the education of children of different ages, primarily in the subjects of maths, reading, and writing. "Terakoya" tended to be a one-room house, but "Hanko" were more organized in planning, having a main hall and several small rooms. There are no "Hanko" and "Terakoya" nowadays, however, some buildings have survived and are on view to the public. "Shizutani Gakko" (built in 1675), whose plan is shown in Figure 1, is one of the best surviving examples. It used to accept not only samurai (warrior) children but also common people (Murasawa, 1980, p. 97, 156).

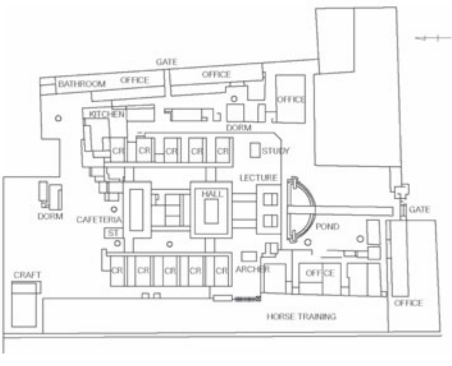

Figure 1. Floor plan of Shizutani Gakko school, Okayama.

R. Walden (ed.), *Schools for the Future,* DOI 10.1007/978-3-658-09405-8_3,

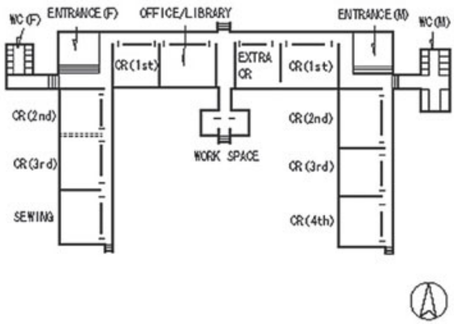

Figure 2. A model school plan of 1895.

The modern public school system with grades was started in 1872 by the central government in the Meiji era (1868–1912). This system established compulsory education and sorted and grouped children into classes by age and ability. Public schools spread throughout the country very quickly. For example, about 25,500 elementary schools were built within five years. Meiji-era school buildings can be classified into two types: the Japanese traditional style, and the style of combining Western and Japanese planning. At the beginning, many local governments made an effort to build semi-Western-style school buildings as a symbol of a new civilization in the Meiji era, however, this only lasted for a short time because the budget demands were too great. The central government also urged local governments to build cheaper and more simple school buildings in order to provide a larger quantity of schools all over the country. Today, some semi-Western-style buildings are preserved as cultural assets (Nagakura, Ueno, Hara, Mimura, Nomura, Moronuki, et al., 1993, p. 7).

In 1890, the central government issued a guideline for elementary school building in order to standardize schools. In this guideline, for example, the number of students per classroom, the size of classrooms, and the style and space of lecture halls for ceremonies were regulated. A few years later, in 1895, a model school plan was issued as shown in Figure 2. In this model plan, classrooms of 65 square meters for 80 students were lined up along a single-loaded corridor to allow for sufficient natural light and ventilation. Most public schools in this period were built using this model plan, so they tend to have similar features. School features from this period, such as classrooms in a row along a single-loaded cor-

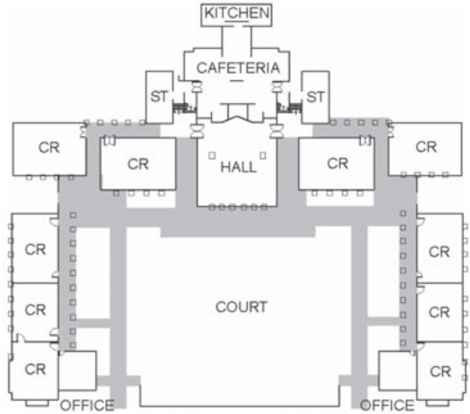

Figure 3. Floor plan of Jiyu Gakuen School, Tokyo.

ridor, are still found in many contemporary Japanese schools and the present school design guidelines are based on the one created in the Meiji era. One of the few exceptions found in Meiji-era schools is the clear separation of classroom units for boys and girls (Ueno, Tanabe, & Yanagisawa, 1995, p. 136–141).

There were few changes in the design and planning of schools at the beginning of the 20th century. Quantitative provisions for standardizing schools was the main objective for the central government. During this period, new subject matters were added such as science, art, library, and home science. At this point, the rooms and spaces were designed to accommodate these subjects. After the Kanto earthquake in 1923 destroyed many schools in the area, the central government promoted a model school built of reinforced concrete. The Tokyo government decided to rebuild 117 destroyed schools using reinforced concrete structures. Some of the buildings were international style, the fashion of this period. Modern conveniences also became popular, such as gas, electricity, steam heaters, and flush toilets (Ueno et al., 1995, pp. 136–141).

The Jiyu Gakuen School in Tokyo is one of the few schools offering excellent design before the Second World War. The first building as shown in Figure 3 was designed and completed in 1921 by Frank Lloyd Wright, who was in Japan to design the Imperial Hotel. The annex building, completed in 1934, was designed by Shin Endo, Wright's successor in Japan. Both are one-story prairiestyle buildings with a spacious courtyard surrounding. Unfortunately this unique school did not influence other Japanese school designers (Ueno et al., 1995, pp. 136–141).

Figure 4a and b. Floor plans of Kato Gakuen Elementary School, Shizuoka.

Figure 5a and b. Classroom and multipurpose room of Kato Gakuen Elementary School, Shizuoka.

After the Second World War, the central government established a new curriculum and revived numerous school buildings destroyed during the war. The central government organized a committee to create new building standards for implementing technology, disaster prevention procedures, and fireproof structures and materials, as well as securing a satisfactory level of environmental quality. In 1949, the government issued two model school plans: reinforced concrete-structured schools and steel-structured schools, as a symbol of Japan's post-war rehabilitation. Consequently, two model schools were built. One was Nishitoyama Elementary School, built in 1950 as a reinforced concrete model school. The other was Miyamae Elementary School, built in 1955 as a steel model school (Nagakura et al., 1993, pp. 34–35).

Nishitoyama Elementary School had unique features such as groupings of grade classrooms, separation of upper and lower grades, the introduction of playrooms, and administration office arrangements for easy supervision. It still followed the traditional Meiji-style school however, with a single-loaded corridor. The Miyamae Elementary School, by contrast, strayed from the traditional Meiji style of school building. The classrooms had windows on the south and north sides, a workspace and a playroom were situated next to each classroom, there was a clear separation of buildings for the upper and lower grades, and a separate outdoor playground for lower grades. Unfortunately, this new model school didn't become popular (Ueno et al., 1995, pp. 136–141).

Several innovative schools were designed in the 1960s. A shift from quantity to quality, and from standardization to variation were trends in school design in the 1960s. Some Japanese school planners and professors created new design paradigms through research on existing schools and reference to foreign schools. In particular, Dr. Yasumi Yoshitake, professor of the University of Tokyo, and his research group designed many research-based innovative schools. Johnan Elementary School, for example, developed in 1965 had three classroom wings for different age groups and various common spaces, a reference to British model schools of the 1950s. Misawa No.5 Middle School, dating from 1965, was the first school to introduce a department system, grouping subject-oriented classrooms. Not only did they challenge design, they also tried to create a new educational system by abolishing traditional uniformity (Ueno et al., 1995, pp. 136–141).

The first open plan schools were built in the 1970s to encourage individual learning and to break up traditional class groups of 40 pupils. This new development was influenced by the open plan school movement in the UK and the USA. Kato Gakuen Elementary School (1972, see Figures 4 and 5) was the first open plan school to be built in Japan. This school is a private school and has large open classrooms; four times larger than the regular classroom size. The room can be divided into four smaller rooms by movable partitions (Kaname Yanagisawa, 1992, p. 171–244). Ogawa Elementary School (1978, see Figures 6 and 7) was the first public open plan school. This school is composed of a gym, a practical classroom building, and an upper grade building and lower grade building. The upper and lower grade buildings have two large common spaces in the center and smaller common spaces in each grade unit. This school is also famous as a pioneer in the development of new curriculum and educational methods emphasizing individual and diversified education. In 1984, the central government started to promote construction of open plan schools by offering an additional subsidy for designing common spaces (Ueno et al., 1995, pp. 160–165).

Figure 6.
Floor plan of Ogawa Elementary School, Aichi.

Figure 7a.
Multipurpose space of Ogawa Elementary School, Aichi.

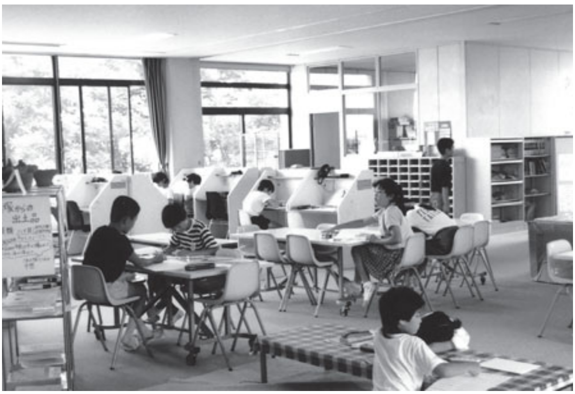

Figure 7b.
Common space of Ogawa Elementary School, Aichi.

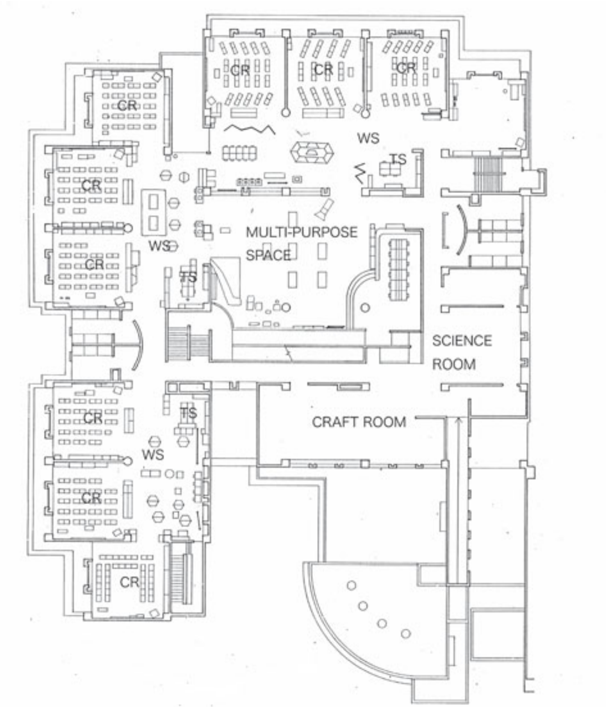

Figure 8. Floor plan of Honcho Elementary School, Kanagawa.

Figure 9a and b. Multipurpose space and Common space of Honcho Elementary School, Kanagawa.

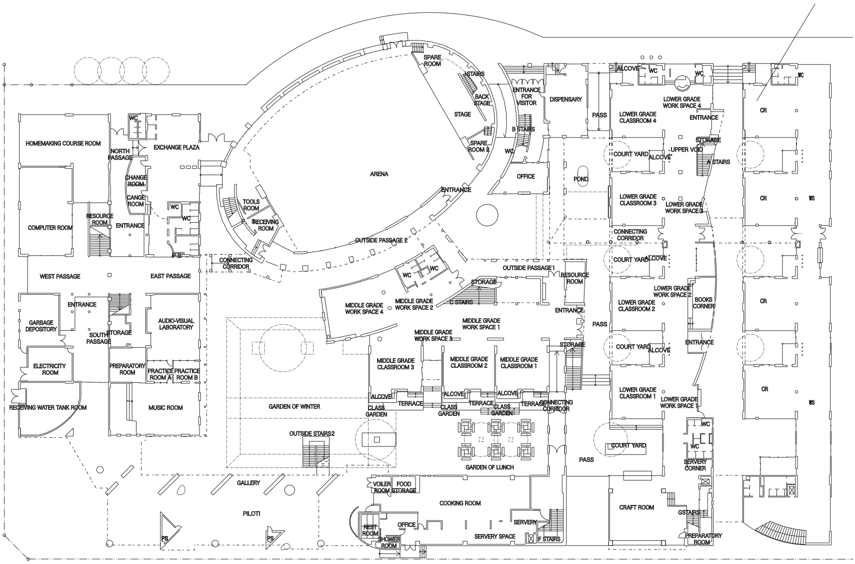

Figure 10a. Ground floor plan of Utase Elementary School, Chiba.

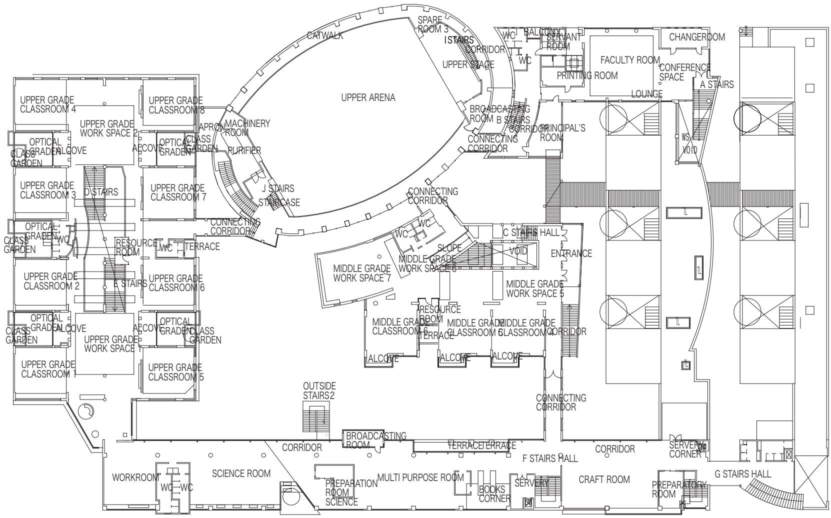

Figure 10b. Upper level floor plan of Utase Elementary School, Chiba.

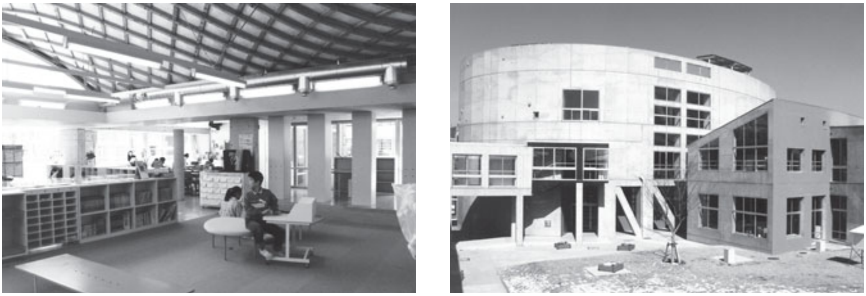

Figure 11a and b. Classroom and exterior view of Utase Elementary School, Chiba.

Open plan schools with common spaces have become popular since 1984. There are several types of open plan schools in Japan. The 'wide hallway' type has hallways more than twice the normal width so they can be used as learning spaces. The 'grade common space' type has a common space openly connected to classrooms in each grade unit. The 'multi-grade common' type has a large common space shared by more than two grades (Nagasawa, 2003, p. 13). One of the most unique examples of the 1980s is Honcho Elementary School (1984, see Figures 8 and 9), which has both grade common spaces and a central atrium used as a common space for all grades (Ueno et al., 1995, p. 166–171).

Some planners and architects of the time criticized open plan schools because many of these schools tended to lack a sense of human scale and private spaces. They created some unique schools, in contrast to the open plan school and even the traditional school, such as schools with independent class houses with additional multi-purpose space, and small alcoves or loft spaces within common spaces. They tried to create smaller and more varied spaces for individuals and small groups. These ideas have not become mainstream in Japan, but have had an influence on some new open plan schools. Kasahara Elementary School (1982) is one of the best examples of these schools. This school was designed in the fashion of a traditional Japanese village, with a series of tile-roofed classroom houses. Each independent classroom has its own entrance for easy access to outdoor space. This school also has many unique design features to stimulate children, such as a star constellation ceiling, a handrail with abacus-shaped objects, and pillars with famous Japanese poems carved into them (Ueno et al., 1995, p. 154–159). Another unique example is Salejiogakuin Elementary and Middle School, built in 1993. The elementary school has independent classrooms, each with its own building, much like a small house (Ueno et al., 1995, pp. 184–189).

Today we see many unique schools in Japan. Noteworthy examples are schools integrating the open plan concept with small independent spaces. Utase Elementary school (1996, see Figures 10 and 11) is the pioneer of these school types. This school has various shaped spaces such as an oval gym, zigzag walls, and curved classrooms, all coexisting in the school. Each classroom unit is carefully designed to be suitable in scale for the activity of each grade. Small alcoves, wide steps, lofts, small courts, and other unique spaces were implemented with the intent of stimulating children's minds and behavior (Akamatsu, 1998, pp. 53–59).

References

Akamatsu, K. (1998). No. 4 school. Chiba Shiritu Utase elementary school, data file of architectural design & detail No. 67 school 2 (pp. 53–59). Tokyo: Kenchikushiryo Kenkyusha.

Murasawa, F. (1980). Shizutani Gakko, school and theater, handbook of Japanese architectural history. Tokyo: Architectural Institute of Japan, Shokokusha.

Nagakura, Y., Ueno, J., Hara, H., Mimura, N., Nomura, M., Moronuki, M., Yamazaki, T., Yamashita, T., Kakehi, A., Morishima, T., & Yasui, M. (1993). Revolution of school architecture. Tokyo: Shokokusha.

Nagasawa, S. (2003). Pioneer of open space type, chapter 1. Education, handbook of environmental design, education and library. Tokyo: Architectural Institute of Japan, Maruzen.

Ueno, J., Tanabe, Y., & Yanagisawa, K. (1995). Space design series No. 2 school. Tokyo: Shinnihonhoukishuppan.

2.3 The Historical Development of School Buildings in Germany

Simone Schalz

2.3.1 Emerging Organized Schooling in Germany

The Middle Ages

The history of school building shows that there always was a close relationship between school building and school process (Wagner, 1967, p. 58). Educational mission, teaching objectives and syllabus were always reflected in the design of buildings, derived from the content of educational concerns (Steiner, 1999, p. 18).

The cathedral schools of the Middle Ages are considered the original seeds of the entire Western school system. Already in those schools, the dependency of content on the educational mission is visible. For the training of future priests, no special spaces were needed. The churches themselves provided the best conditions for this instruction that was aimed less at a "comprehensive understanding of abstract relationships" (ibid. p.18) than at memorizing psalms and prayers for mass.

In 16th century Germany, education was still solely the domain of the church. Its members provided schooling in council and parish churches. Mainly concerned with educating new recruits for the clergy, the instruction was based on the catechism published in Cologne in the middle of the 16th century with the title Book of Christian Instruction. The educational content at the time was completely religious. Other than reading, there was no concern for basic subjects of writing and arithmetic.

As commercial activity increased and trades and industry flourished, little by little, the schools were also opened to students who were not prospective clergy. This brought about some changes in the curriculum: Besides catechism studies, the schools began to offer reading, writing, and arithmetic. The previous "religious-artistic" orientation began to yield to a more "mercantile-utilitarian mindset" (Raab, 1982, p. 14).

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However, education remained the privilege of the church, wealthy citizens, and nobility until well into the 17th century. Books could not be widely distributed until Gutenberg's invention of the printing press in the middle of the 15th century. Ideas about popular education and the notion of common literacy only arose with the further development of printing technology in the 17th century.

Emil Rieke describes the state of school building in the 16th century as follows: "The school house, part of the church complex, initially only contained a single schoolroom and a living and sleeping space for the teacher. During the breaks, the children played in the churchyard and cemetery and had (so it was said) considerable fun there. In the schoolroom, the teacher supervised his often more than hundred pupils from his elevated lectern seat. The children sat at his feet on benches, separated according to age groups.

The teaching was based on obedience, mechanical drill, formalistic and boring, and entirely lacking in psychological sensitivity. The educational concern of this training, or disciplining" (called Zucht – a word also used for the training of animals by means of discipline and punishment) "was aimed at the indoctrination of religious values and virtues such as diligence and industry, honesty, respect for adults, and authority. The indispensable disciplinary tool, the rod, was always ready within arm's reach behind the teacher's chair, in a bucket of water" (Raab, 1982, p. 14).

School was usually held only during the winter, since children were needed for field labor during the summers. This was a vital survival necessity for farm families.

The profession of a country school teacher was not a very attractive one. Salaries were meager and the reputation of teachers was poor. There was no organized education of teachers. Basic instruction was usually offered by clergy, custodians, or artisan journeymen in addition to their regular work (cf. Herrlitz, Hopf, & Titze, 1981, p. 54).

The classrooms were sparsely furnished, in rigid orderly and utilitarian design. The windows, high up in the wall, offered neither views to nor sensory experience from the outside. There was no regard for the interests of students; at best these would be accommodated during breaks or on the way to and from school (cf. Dreier, Kucharz, Ramseger, & Sörensen, 1999, p. 33). Maria Montessori describes the reality of schools of that time as follows: "The school is, for the child, a place of extreme desolation. Those immense buildings seem to be built for a host of adults. Everything is designed for adults, the windows, the doors, the long hallways, the bare, monotonous classrooms…" (Maria Montessori, 1909, cited after Böhm & Flores D'Arcais, 1979, p. 57). The instruction was characterized by uncritical deference to authority and lack of relationship to real life. It should be obvious that successful teaching and learning under such conditions would be possible only in scant approximation.

In the almanac of Bitburg County in Germany (near Luxembourg), one Mr. Oster reports: “Wherever a school is appearing, it is purely a church endeavor, founded upon the bishop’s request, run by the cleric, and supervised by the parish priest (Heimatkalender Kreis Bitburg, 1965, p.140). In 1684, the Archdiocese issued a call for the establishment of more schools. Each family should pay an annual tribute of a half “Taler”; this was hoped to improve attendance. In 1685, this was followed by laws making school attendance mandatory – because at the Prince Elector’s visits to schools, only very few of the school-age children (7–11 years) were actually present.

Early Reform Pioneers

At approximately the same time, the pioneer of modern pedagogy, Johann Amos Comenius (1592–1670) made his proposals for humane, student-friendly schools in his Didacta Magna (Great Instruction Guide). He championed a new teaching method and advocated age-based classes, which would make it possible for the teacher to work with all students in one class at the same time. He explains that “the curriculum should be divided carefully according to classes, so that the earlier studies will precisely prepare and illuminate the following path” (Raab, 1982, p.14). He adds that it would be “especially beneficial if the walls of the classrooms were adorned with excerpts from books, pictures, and drawings” (ibid., p.14). He recommends that the school should be located “in a quiet place far from distractions and disturbances [...] The school itself should be a lovely place, a feast for the eyes inside and out. Inside, there should be a bright, clean room, decorated throughout with pictures. Outside, there should be an open space for walking around and for common games, but also a garden into which the pupils should be sent every once in a while, to feast their eyes on the sight of trees, flowers, and herbs” (ibid., p. 14).

Comenius’ ideas were considered utopian at the time, and their realization would have to wait for centuries. However, it is remarkable that the very first attempts to humanize schooling already clearly recognized the relationship between the design of the educational environment and the teaching and learning process.

With the strengthening of the mercantilistic movement, there was also a growing division of responsibilities for education. On the one side, there was still the church; but now on the other side stood the city, respectively individual city councilmen. “The supreme school authority was the school council. Teachers were appointed solely by the council, which now appeared determined to not give up control of its own school again.” (Raab, 1982, pp. 14ff.).

In the 18th century, the education issue intensified: The increasing pace of industrialization changed requirements for the work force. Innovation and ever more complex production processes demanded more qualified training of workers. “Absolutist rulers could not use illiterates for the implementation of their economic policies” (Raab, 1982, p. 15). And Pietism, with its devotion to work, brought forth “one of the most depressing forms of schools”: the industrial school. It was dedicated to the “supply of a capable and obedient work force that would willingly submit to the existence of factory worker” (Steiner, 1999, p. 23).

Primary educational goals were patriotism, work ethic, and obedience. These were reflected in the content of the instruction offered. To a significant extent, it consisted of reading and memorizing religious texts, complemented by writing and arithmetic. “This tradition persisted unbroken well into the 20th century” (Raab, 1982, p. 15).

At the same time, the philosophical writings of Jean-Jacques Rousseau (1712–1778) that touched upon education, as well as the ideas of Johann Heinrich Pestalozzi (1746–1827) began to influence reform movements in reaction to these mainstream school practices. However, these movements were to coalesce only around the end of the 19th century.

After 1871, the German school system became a centrally governed institution of the state. The Prussian regulations of 1895 called for a class size of 46–54 children with a space allocation of 0.9 square meters (9.7 square feet) per student. The classrooms were extremely crowded. Strict order reigned to the smallest detail (ibid.).

2.3.2 School Buildings in Cities and Villages

Country Schools

There were significant differences between schools in cities and those in the countryside, even in terms of instructional content and learning atmosphere.

The predominant school type was the undifferentiated country school. In Prussia in 1886, there were 30,298 country schools as opposed to 3,718 in the cities. By 1911, the total number of schools had grown to 38,684. Of these, 33,559 were country schools and only 5,125 were city schools (cf. Herrlitz, Hopf, & Titze, 1981). Even so, in some villages, children had to walk several kilometers to school. In some rural areas there was a significant shortage of both space and teachers, so smaller villages often formed a common school association. The centrally located village became the site for the school; the costs for construction and maintenance and operating costs were shared.

The school was – for example, in the Eifel region, from 1750 onward – located near the church, in the center of the village. It was usually a building much like a farm building but with larger windows and a visible entrance gate. The teacher's apartment was integrated into the building. Toilets were often found in separate sheds, which also contained storage areas for supplies like wood and tinder for the stoves, later coal and briquets. The school yards were graveled, sometimes paved with cobblestones – which already identified the community as a well-to-do one. The site was surrounded by hedges or low walls to separate the school yard from neighboring areas such as the cemetery or orchards and gardens of nearby farms. These village schools were solid two-story buildings with windows and posts framed in natural stone.

From 1820 onward, we learn from the school yearbook of Koxhausen in Bitburg-Prüm County, school building became a matter of prestige. The school was to be a stately edifice, states the chronicle. The single school room had an almost square plan of 10.5 × 9 meters (about 34.5 × 28.5 feet). Map cabinets were set into the wall, which was over 0,7 meters (2 feet) thick. The building team as well as the sponsoring groups were focused on the hope that

“ • our children will be proud of their schoolhouse;
- our children will feel comfortable;
- our children will love to come to school;
- our children will be protected from the cold;
- our children will experience the joy of learning and form a successful community.”

The expression “the village's own school” was both fact and program at the same time. Local history and geography, flora and fauna, reading, writing, arithmetic, bible and catechism study, poems and songs formed the mainstay of the instruction.

Country schools had to keep several grade levels in one common room, for example, grades 1–4 in one, grades 5–8 in another, but at times even grades 1–8 in one room.

Schools in Cities

In contrast to schools in rural areas, city schools could afford to keep grades in separate classrooms. Their buildings were correspondingly large, with a wide entrance and staircase, and long hallways. Restrooms were located in the basement, clearly separated for boys and girls, with entrances placed far apart. Additional spaces such as a principal's office, teachers' room, assembly hall, gymnastics hall, and specialty classrooms could now be found in these buildings. From the exterior, they were recognized by their endless rows of windows and several stories. Entrance and school yard were paved, and quite often the city's crest or the emblem of the respective neighborhood was embossed above the front gate. Flags were flown on special occasions that did not necessarily relate to school life but rather to civic or political events.

The interior of classrooms was usually simple and sober. The required school equipment consisted, according to regulations, of benches and tables, teacher's table and chair, a cabinet, blackboards, a foot stool, chalk and sponge, inkwells, and coat hooks (Engelmann, 1905, p. 86). Every classroom also had to display a crucifix. Permanent decoration consisted of geography maps and some picture boards on the rear wall featuring themes from history and natural sciences. Students' attention was to be focused on teacher and blackboard. For many decades, lecture-style instruction was dominant, favored or even enforced by the plan arrangement. Flowers on window sills were not as common as in country schools. Little attention was given to principles of direct and practical experience – for example, with respect to natural science subjects or seasonal phenomena. In the middle of the 19th century, these mammoth schools had developed their own rhythm in the course of the school day: The school bell established the firm time framework and a certain uniformity.

The teacher's authority was the central feature of the schooling. Forms of participation remained in an embryonic state for many decades. The rigor of the instruction was reinforced by the design. There were no side rooms, hallways could not be included in the teaching process, there were no cabinets, no space dividers, no self-designed corners or special areas. In order to get the large number of children out into the courtyard for breaks and back into the classroom again afterwards in an orderly manner, everybody had to move in file.

These school buildings with their rigid spatial organization and infrastructure were accepted as given and unchangeable by all users. Suggestions for improvements were neither called for nor expressed.

In 1875, the German Empire had a population of 42.7 million people, and it grew to 67 million by 1914. Together with proportionally higher numbers of children per family, rural-urban migration to the new industrial workplaces, new restrictions on child labor and increasing pressure to attend school, this led to a considerable increase in the number of school-age children. It became necessary to build many new schools. “The architectural expression of schools is simple and severe. A comparison with military barracks is obvious and unsurprising: order, discipline, strictness, and cleanliness were almost necessities in these schools with class sizes of up to 70 children" (Kähler, 2004, pp. 21, 23).

A glance into the school chronicle of Trier-West shows an example of the development of a city neighborhood which mandated new school construction. From 1872 onward, the number of students had grown very quickly, due to three new military barracks, a railway factory, and an electrical power plant, with corresponding businesses and housing projects. Earlier, students had to cross the river on the old Roman bridge to go to the St. Antonius school in the old part of Trier. It had class sizes of 70–100 children, separated only by gender. Shortening the distance to school by about 3 kilometers for the children of Trier-West, their new school featured classes separated by grade and gender throughout. It grew to 906 students by 1931, which then still translated into class sizes of about 57 children. All spaces were bright and friendly with modern conveniences. There was a total of 21 classrooms on two levels, along the long double-loaded hallway. In addition, there was a school teaching kitchen, craft room, art room, teachers' room, conference rooms, and consultation room.

It still can be recognized as a "distinguished" barracks-like building. But the citizens' opinion was that this was a place for "fresh and joyous work for the benefit and joy of our youth, a home for genuine religious spirit and true patriotism [...] a school house full of light, air, and sun [...] a precondition for sound and prosperous activity" (School chronicle Trier-West, 1976, p. 16).

2.3.3 Reform Pedagogy (1890–1932)

This brief sketch of the history of school building would be incomplete without mentioning the reform movements which began around the turn of the 19th to the 20th century. The term "educational reform" of this period actually refers to a multitude of pedagogical ideas within an overall movement in the late 19th and early 20th century (1890–1932) that began to take a stand against the predominant "drill schools" with their remoteness from real life, their intellectualism and authoritarianism.

There were educational reform movements for school communities, for country boarding schools, for art education and adult education, for work schools and adult education. The motto was "school as life style." This was closely related to a concern with the design and redesign of educational environments.

The 19th century had brought profound technical and cultural changes that by and by affected all domains of life (Oelkers, 1996, p. 39). Criticism of existing schools was as commonplace among educators as the recurrent discussions about reform efforts. Targets of criticism were above all the prevalent organization of schools, fixated upon method and discipline, without becoming a place of learning "in tune with the needs and potential of child learning" (ibid., p. 129).

The School Conference of 1890

It is not possible to put a specific date on the emergence of the "reform pedagogy" movement. The 1890 school conference called by the German Emperor did embark on a critical scrutiny of the existing Prussian-German school system, but is not considered to be the beginning of the movement. The emperor remarked in his speech that the educational method of the time – called "gymnastics of the mind" – did not convey knowledge about the conditions needed for learning, and that the educational mission of the school was being neglected. A positive outcome of this argument was the demand that school learning be "useful and beneficial for (real) life" as well as contributing to the formation of character. After 1890, there were no reform initiatives that neglected to refer to these objectives.

Ellen Key

In 1900, the Swedish teacher Ellen Key (1848–1926) published her pedagogical blueprint for the "Century of the Child." In spite of the difficulty of dating the beginnings of reform pedagogy, some authors – for example Scheibe (1999, p. 52) – consider the work of Ellen Key as its starting point. He credits her with having formulated the first outline of the new pedagogy and the new school – a "school of the future" (Key, 1992). She was a devoted follower of the educational ideas pioneered by Jean-Jacques Rousseau (1712–1787) of "letting the young person grow" naturally. Her pedagogical plan centers upon the dignity and individuality of each child that adults should approach with respect. Key herself describes her concept as follows: To calmly and slowly let nature help herself and only ensure that the surrounding conditions support her work, that is education in the opinion of Key (1992). She calls for active involvement and freedom of choice of the topics of instruction by students, and for teachers to retreat from their dominant role, instead stressing their new role as supporting advisors.

Hermann Lietz

Among the projects inspired by the reform pedagogy ideas was the work of Hermann Lietz (1868–1919), the initiator of the movement for country boarding schools (Landeserziehungsheime) and founder of the first such school ("Pulvermühle" near Ilsenburg in the Harz mountains, in 1898). In his books, he articulated his extremely critical attitudes toward the city, toward "civilization, and the spirit of the times" (Zeitgeist). He opposed the knowledge drill and strictness of the 'old school' that he himself had to suffer in his youth.

His schools were located outside the cities. He believed that children should be imbued with "love of nature, and the experience of nature as the original, pure, and healthy world." These schools were to become second homes for the students, and at the same time facilitate "total education" (Scheibe, 1999, pp. 118–124). Groups of up to 12 students lived together with their teachers and formed a kind of second family. The primary goal – besides learning scientific-intellectual activities (in studios, workshops, and outdoors) – was to experience community. A clear daily schedule emerged: Academic instruction took up five hours in the morning. After lunch and some free time, the afternoon was devoted to practical work in the workshops, studios, or gardens and fields. In the evenings, the entire community gathered for the daily prayer to conclude the day together (ibid., 1999, p. 134).

Georg Kerschensteiner

The integration of work into the educational process was promoted primarily by Georg Kerschensteiner (1854–1932) in the work school (Arbeitsschule) movement he started. Between 1890 and 1933, the concept of "work school" became a synonym for the entire reform pedagogy movement and considered the essential "new school." Kerschensteiner saw the activity in the work school primarily as the combination of manual work and intellectual scrutiny of that activity. He was a determined opponent of the traditional "book learning" and accused it of being one-sided and remote from reality, in that it focused primarily on intellectual abilities, while the majority of the students would have to pursue work involving manual activities in their later life.

With this call for including manual work into education, Kerschensteiner took up ideas that could already be found in the 18th century writings of Rousseau and Pestalozzi, for example (under the motto of "hand, heart, reason"). In these schools, students were mainly working in the school's kitchen, gardens, workshops, and laboratories. Their guiding principles were realism, morality, and independent activity. Kerschensteiner was the first to think through the theory of occupational training. His dual educational system has been maintained to the present day. For that reason, he is often cited as the "father of the trade school" (Scheibe, 1999, p. 180).

Maria Montessori

Around 1900, the Italian physician Maria Montessori (1870–1952) opened her first children's homes (case dei bambini). Her educational philosophy was dominated by the principle of individual self-guided activity and her child-centered approach. Her ideas generated not only new didactic materials but also valuable concepts for the design and organization of living spaces for children. She started from the belief that from the moment of birth, every child has "the ability to develop into an independent human being through active exploration and learning processes" (Dreier et al., 1999, p. 35). To facilitate such a learning process, it is important to create an environment that is pleasant and comfortable for children, as well as to provide "stimulating and inviting, challenging" learning materials (Scheibe, 1999, p.67). She decorated classrooms with a rich range of materials and media aimed at encouraging children to experimentation and exploration.

"Intellectual curiosity, excitement and discovery require a continual interaction between the child and its environment" (Montessori, 1909, p. 47). The children begin to interact playfully with the prepared material. Teachers remain in the background, because "the control lies in the material itself, and in this way the child is led from play to planned activities and work" (Scheibe, 1999, p. 67). In the literature, this process is often referred to as the "Montessori phenomenon." It creates the conditions for children to develop their abilities from their own interests and inclinations.

Her most important innovation in classroom furnishing is the "abolition of school benches" (Montessori, 1909/57, in Dreier et al., 1999, pp. 35–36). To create an environment appropriate for children, Montessori ordered special cabinets, shelves, chairs, and tables which children could carry around effortlessly. In addition to the equipment, architecture and colors are equally geared to the needs and potential of children, and open up spaces for autonomous movement. Montessori herself describes her interiors as "simple but graceful," allowing the child to "assume the posture it perceives as most comfortable" (ibid., p. 80).

Peter Petersen

"What should an educational community be like in which, and by means of which, a human being might perfect his or her individuality towards a personality?" This was the question that preoccupied Peter Petersen (1854–1952) (Petersen, 1927, p. 7). He sought to realize this union of individual and community primarily through a new organization of the school. He abandoned the principle of separation of grades and instead introduced so-called "tribe" groups of students teamed up according to subject interest or other aspects. They included two or three age groups, so that students of very different ages were now working together. With these organizational changes and more differentiated instructional content, Petersen achieved a loosening-up of the rigid structures of the old school, and a more flexible educational process. However, Petersen saw school reform not only as organizational change, but also as a design challenge (Oelkers, 1996, p. 190). He felt that development of a new school architecture was needed. For this, he proposed to redesign classrooms as “school living rooms.” Tables and chairs instead of school benches provided more flexibility and individual arrangement opportunities. Students are offered a variety of work materials, books, and objects, so as to turn these school living rooms into the best possible stimulating instructional environment (cf. Dreier et al., 1999, p. 35).

According to Petersen, other necessary spatial conditions for a positive community life are “easily integrated outdoor areas, inviting entrances, spacious break areas, and generously designed hallways and assembly areas.” A good esthetic design would give children “opportunities for retreat and relaxation” (ibid.). “Celebrations, mentoring group projects, and performances” (Petersen in Oelkers, 1996, p. 160) keep school life attractive for everybody involved. Petersen combined educational theories and practice with the help of the university’s intern program (Scheibe, 1999, p. 310). He collected his ideas in his books “Little Jena Plan” (Kleiner Jena-Plan, 1927) and his three-volume “Great Jena Plan” (1930–1934). It is noteworthy that the Little Jena Plan reached many more readers than its successor, which explains why it is considered the “most successful document of the German reform pedagogy” (Oelkers, 1996, p. 159).

Rudolf Steiner and the Waldorf School

The founder of the Waldorf school movement, Rudolf Steiner (1861–1925) recognized the connection between space and human education early on, paid special attention to the “spatial dimension of school building,” and focused on color design and a shift away from the right angle. “Architectural forms deeply influence body, soul, and spirit of the child and young person; the life-giving spirit lives in them” (Dreier, et al. 1999, p. 37). According to Steiner, “architecture is in the service of the valuable act of education” (Steiner, 1961, in Dreier et al. 1999, p. 37). The typical watercolor-like color scheme of the Waldorf schools with its alleged transcendental, moral, and spiritual effects was supposed to contribute to the holistic development of students.

The private Waldorf schools, which have been in operation now for over 75 years, can be recognized at a glance everywhere in the world because of their special individual architecture: The building forms are asymmetrical and vault-like, often the classrooms are reminiscent of cathedral naves. Their interiors are color-coordinated to the last detail. (Steiner was very much involved in studying color theory. During their time at the Waldorf school, students move first through orange-red, then yellow, and finally blue-violet classrooms.) Waldorf schools contain halls for theater, eurythmy (dance) performances, and concerts, as well as multipurpose areas and workshops. Rudolf Steiner schools saw themselves as both life communities and cultural centers (ibid.). Their ideological coherence is, among other things, the reason why "this element of the education reform movement has remained alive in unbroken tradition up to the present" (Scheibe, 1999, p. 307).

2.3.4 The "Reform Wave" (1918–1933)

The Weimar Compromise

Between the two World Wars, another reform wave occurred in Germany. It was triggered by the 1918 abdication of the emperor, which brought a time of unrest and uprising; the November revolution and proclamation of the first republic. After that year, the schools' reading books no longer featured stories of the emperor and his family. The connection between church and school was broken by the abolition of the state church and church supervision of schools. The "school struggle" began. During the time of the empire, private teachers, private schools, or preschools had still been in charge of the elementary schooling of the children of the bourgeoisie. These institutions were especially opposed to the unified school system imposed by the "Weimar school compromise." All children, regardless of which social strata they belonged to, now attended the same schools. This was a step toward greater equality. But many reformers started their own (private) schools.

Célestin Freinet

The ideas developed during the 1920s and 1930s by the French elementary school teacher Célestin Freinet (1896–1966) must be counted among the European reform pedagogy efforts. Inspired by the ideas of leading reform educators of his time (for example, John Dewey, Maria Montessori, Helen Parkhurst, and Hermann Lietz) and in close cooperation with like-minded colleagues, he developed a practice-oriented concept for the reorganization of the school day, as well as "work techniques and instructional aids, of which the school printing shop became most widely recognized" (Dietrich, 1995, p. 13). In addition, Freinet started a teacher movement, which still counts thousands of members in France and in over 30 countries in Europe and on other continents.

“Decisive orientation toward practice and organized cooperation of teachers are the two main pillars of this concept. It is based on the belief that work is a natural and fundamental need of the child, and significantly influences the development of the child’s personality” (Dreier et al., 1999, p. 39). Implementation of the Freinet approach requires a change of interior learning patterns and exterior forms of instruction. The most remarkable differences, compared to the normal school, are the rejection of textbooks, the right of the children to decide the place and social organization of their work by themselves, rejection of the three-quarter-hour rhythm of the school day, reduced teacher-centered instruction, and the division of the classroom into separate workshops and work corners. Centerstage is taken by the goal of “free unfolding of curiosity, work spirit, and children’s desire to learn [...], which can be achieved in small steps” (Dietrich, 1995, p. 25). Self-organized learning through communication and cooperation, trial and experimentation, and through activities in the workshops that are equipped with a wealth of materials and tools, offer multiple opportunities for children to freely express themselves. The classrooms look like small studios and have a workshop-like character. The arrangement of tables and separate zones permit undisturbed work both individually and in self-selected groups. A printing press and various other materials and simple tools are in the classrooms, which are richly decorated with artwork created by the children. “The workshop character of the classrooms allows the children to move about freely and to develop, to work together as a community, and to mutually stimulate and support each other” (Dreier et al., 1999 p. 40).

Helen Parkhurst

Also influential in this period was Helen Parkhurst’s Dalton Plan of 1920. She initiated the provision of “subject corners” in classrooms, which contained materials for the individual use of students (Hegele, 1996, p. 7). Students were encouraged in self-guided learning based on their different inner motivations. Initially, such station learning in the form of training circles was found primarily in sports training. Over time, it has been tried out and integrated into almost all other subjects. In comparison with other forms of open learning, it can be seen to give teachers the opportunity for more aggressive, better, and stronger thematic emphasis, and to give students more freedom and responsibility. The core is always a topic from the syllabus that is divided into partial themes by the teacher and then arranged in stations around the classroom, identified by colors, symbols, or sign markers. Before beginning, each student is given a list of tasks which can help in organizing the work, but which also help the teacher to quickly see the progress of work at the end of the class. In a first discussion, the overall topic is introduced, followed by a walk around the space with explanations of the individual stations. Then, work at the stations begins. Students are encouraged to work without interference from the teacher; they can decide the sequence of the stations and the social form of cooperation. There is no time pressure; students can work at a station as long as they want. The disadvantage is that not all instructional topics can be organized in this form of station learning. An important condition for success is sufficient space to prevent the children from getting in each other's way when working. Learning is made easier when the group already has some experience in independent study. At times, students take the initiative to go beyond the borders of the classroom, and begin to include part of the hallway, a nearby available space, or even a staircase landing in their work space. Such opened-up instruction forms therefore create expanded spatial use patterns, a remarkable fact that has made architects take notice.

2.3.5 The National Socialist Takeover

Following its takeover of the German government in 1933, the National Socialist (NS) regime then brought the public schools completely under its control and into the service of its politics and ideology. Around 1939, the elementary school system was unified; the "German People's School" replaced the traditional confessional schools. From this time on, the school was to serve one single political mission. This included, especially, indoctrination of the NS world view as well as the education to an "uncompromising National Socialist way of life" and the training of "fit and healthy bodies" (Dannhäuser, 1997, p. 14). Racism and anti-Semitism were dominant premises. "Race consciousness" was to be the prime instructional principle in all subjects. The development of cognitive and intellectual skills took second place. The NS dictators had adopted the goal of "unscrupulously training young people to the NS-conforming mindset, blind obedience, and total dedication to the leader state" (ibid, p. 19).

In this way, the schools became the tools of one party and at the same time the most important institution in the educational realm. The commands of the power structure were implemented without question, according to the maxim "the individual is nothing, the nation is everything." Teachers were to fulfill a "leadership mission" which consisted in a "somewhat superficial but insidious nationalistic and racist reinterpretation of traditional instructional content and forms. A firm integration of the schools into the political apparatus took place at the same time as a hidden competition between the schools and the youth activities of the party, which the schools often lost" (Meyer 1989, p. 76, cf. 1999).

2.3.6 The Postwar Period

2.3.6.1 Emerging from the War

The collapse of the Third Reich offered the chance for a fundamental reshaping of the school system. At the August 1945 Potsdam Conference, the victorious Allied powers decided to democratize and supervise the German educational system. Initially, however, such a reorganization of the educational system "in the spirit of democracy" (Dannhäuser, 1997, p. 20) proved to be difficult. The war's air raids had left many schools severely damaged or entirely destroyed. Many remaining undamaged schools were used as hospitals, housing for refugees, or requisitioned by the Allies for other purposes. In addition, widespread malnutrition reduced the physical and mental capabilities of students and teachers; cases of complete physical breakdown increased during the postwar years (ibid., p. 25).

Further problems arose from the program of "cleansing the teaching body" adopted by the Allied powers. All teachers who had been members of the National Socialist party before May 1, 1937, had to be dismissed, regardless of their individual situation. Only after 1946, distinctions between major and minor offenders, hangers-on and "guiltless" members were applied (cf. Dannhäuser, 1997). The dismissal of large numbers of teachers in the face of the rapid rise of student numbers caused primarily by the almost eight million refugees (Lederer, Pieper, & Kötz, 2004, p. 38) led to catastrophic conditions in the schools. at the same time the need for more classroom space increased dramatically.

During the first years after the war, the federalist traditions of the Weimar era were revived in the western part of Germany.

The school system in the East was reorganized along the lines of Soviet pedagogy. This meant: A unified school with emphasis on polytechnic content, run according to severely disciplinarian guidelines, in school environments that had no esthetic qualities but were rather reminiscent of the war and its destruction. The children, many of whom had lost family members during the war, were traumatized by their cruel experiences. "Internalization of behavioral norms and other facts of their reality occurred under the general premise that the children had to fend for themselves, had to educate themselves. This was a form of self-guided socialization. The children had to develop considerable ability to cope on their own, which also led to a certain self-confidence." (Rolff & Zimmermann, 1990, p. 46). Instruction was limited to the bare necessities.

A teacher from those days described the school buildings as follows: "The schools where I was sent to teach had all been built in the early decades of the century [...] Renovations were restricted to the bare necessities" (Hildegard Bolle in Dannhäuser, 1997, p. 237). About the conditions of the school buildings we learn that: "There was a lack of many necessities. The building was old and primitive. There were separate latrines without water service" (ibid., p. 289). Sahm Kreszenz describes a school house, a log cabin in what had been a beer garden in better times. "A rough, crude floor made of planks that squeaked at any movement. Narrow windows only admitted dim light. A simple lamp hung from the ceiling in the middle of the room that measures about 25 square meters (5 × 5 m, or around 16 × 16 feet). A tall stove stood near the wall. The benches dated back to the turn of the century, with fraying, splintering wood on the desks and folding seats. There were no books, no paper" (ibid., p. 290).

2.3.6.2 The Decades of Recovery

All architecture, including school building, is subject to changes over time and so becomes a recognizable mirror of society. During the 19th century, calm dignity, power, and authority were the decisive design criteria. For the many schools that had to be rebuilt after the war's destruction, a new attitude emerged: In West Germany, the new schools were to express "freedom, openness, and naturalness" (Lederer et al., 2004, p. 38). This was often guided by ideas from the 1920s; the "design elements of the reform schools experienced a renaissance" (Engel & Dahlmann, 2001, p. 8). Two-story schools with light from two sides in the style of Franz Schuster were designed and built well into the 1960s in many variations. At the same time, an interdisciplinary grouping of educators, architects, and school administrators began to collectively develop building solutions that would be more appropriate to the nature of young people (Klünker in Mitter, 1994, p. 8). Pestalozzi's idea of the "school living room" was taken up again and brought into the debates about a more child-oriented school design.

Playfulness, joyful arousal, illusion became more predominant not only from the point of view of users but perhaps also for architects (Rittelmeyer, 1994, p. 78). After the war, people began to write about user needs in schools. "During the 50s and 60s, we begin to encounter concepts such as 'rationality, light, air, flexibility, decisiveness, relaxed building forms, simplicity, economy, clarity, order, ease of orientation, cleanliness, functionality, and modernity" (ibid., p. 79). But, as described in Rittelmeyer's report on the typical changes in school design, the expectations and desires of students have only been investigated during approximately the last four decades.

2.3.6.3 Schools of the 1970s

In the 1970s, it seemed that the worst time in school construction had arrived. The world view of the era, one of almost unlimited faith in technology, seemed to result in the abandonment of the ideals of the early postwar years. Schools were only evaluated according to their multifunctionality and economy of use (Engel & Dahlmann, 2001, p. 9). A quote from Budde and Theil (1969, p. 67) illuminates this way of thinking: They call for “bringing the school back out of its green ghetto” and for school design to be guided more by factors such as increased efficiency and potential savings. While the integration of schools into their surroundings remained a desirable goal, it would have to take second place behind economic necessities.

Enormous school centers were built, impressing mostly by their size and compactness. They were seen as an effort to support social interaction and lively communication. Windowless schools were characteristic for this period. An article in the architecture journal Bauwelt even featured the following caption for a picture of such a new school: “Of course there are windows in the IGS” (Integrated Comprehensive School) “… but the daylight entering the building is a mere byproduct of the so-called light bands. The planners knew that in this compact building form, an equitable illumination could not be achieved by means of daylight.” (Steuerwald, 1975, p. 205). This shows that the experts did not always meet the real user needs in their solutions.

The intolerable atmosphere of the windowless rooms led to an increase of vandalism and graffiti. In his book Organismus und Technik (Organism and technology), Kükelhaus (1971) describes a completely windowless and totally white school in New York that students called “the white hell.” The effect of these spaces and their furnishing on teachers and students in time led to neuroses and phobias, but also to increased aggressiveness and developmental problems (Goldstein, 1996).

2.3.6.4 Reorientation Efforts

Arpad Asztalos, an expert for school development in the Lower Saxonia Ministry of Education, must be counted as a spokesman for a group of people who tried to remedy the building sins of the 1960s and 1970s and find new roads towards a more child-friendly architecture. In his 1981 position paper Empfehlungen im Schulbau (Recommendations for school construction) he calls for schools that would adapt to the needs of students by means of “logical and functional space relationships, varied building and room forms, inventive furnishings, differentiated color schemes and choice of materials, appropriate to students in scale and structure” (Asztalos in Mitter, 1994, p. 14).

2.3.7 School Construction Today

Does today's school design pay more attention to the real needs of children? True, they are now actively involved in planning, by means of many studies and surveys. But there are already signs of different trends in school design: Designs flooding the senses with stimuli on the one hand, and cold buildings with a lot of concrete and corrugated sheet metal and highly individualistic artwork on the other still make one wonder when, finally, all parties involved in school building really will be working with the interests and needs of future users in view (cf. Rittelmeyer, 1994, p. 81).

School building in Germany today is very different from that of earlier periods, as a result of more advanced pedagogical insights. Often, an educational concept is determined during the early planning stage, upon which the architectural design should then be based. The spaces will allow different uses, responding to the concept. The uses for many sequences of rooms can even be changed after occupancy; allowing for multifunctionality. However, "basically, the architectural design of a school is a condition that will influence the educational work for decades" (Faust-Siehl, Garlichs, & Ramseger, 1996, p. 200). Many architects have by now realized how classrooms act as shells for the life and teaching that goes on within them. There is a mutual interaction between the spaces and the relationships that develop inside them: "Successful life and learning depends on a beneficial spatial design" (ibid., p. 54). Rooms in use will mirror the habits of their user group; they will reveal what is going on in them, what the group values, whether children and teachers love to occupy the rooms and are working together. To create the a feeling of being sheltered, which is especially important for elementary school children, it is necessary to design the spaces in view of children's physical, perceptional, and emotional needs. Generous, varied furnishings and lively, esthetic design that invites children to "experience, understand, and create" (ibid., p.55) will help to achieve this.

Architects carry a significant responsibility for students', teachers', and other users' feelings of well-being in the school building, for joyful teaching and learning to occur in the building, and for the users' sense of identification with their learning environment. For this reason, it is recommended that users be included in the planning process from the beginning, to be given the opportunity to voice their ideas, expectations, and needs; but also that there remain sufficient room for their own creative contributions later, after occupation.

Exemplary work is being carried out in this regard by the Cologne-based architectural partnership of Peter Busmann and Godfried Haberer (who have become know for their plans for the Philharmonic and the Wallraf-Richartz Museum in Cologne). From the conceptual design phase onward, the two are less interested in the architecture itself than in the feelings it will generate in users (cf. Flagge, 1996). The emotional impression of the whole is more important to them than the superficial visual look. They are constantly concerned with "looking to the inside." They are searching for an architecture that will activate the senses, and refer back to the educator, artist, and writer Kükelhaus and his motto of "living with the senses" (ibid., 1996, p. 46). Peter Busmann sees a major problem with school building in the fact that schools are built for children by grownups, whose priorities are mostly very different, and at times even diametrically opposed. (ibid., p. 46). For the construction of the school in South Brühl, the architect maintained close contact to teachers and students. The students were involved in a common project with an artist for the artistic decoration of the school; they were able to design and embellish a part of the building.

Regarding participation by students, Dreier et al. (1999, p. 106) make the following recommendation: "We propose to set aside at least 10% of the construction funds for the unrestricted use by the school after completion of the building, so that improvements and user-friendly changes can take place during the first phase of use."

Gump (1978) calculated that from kindergarten up to 12th grade, a person will, on average, spend about 14,000 hours in educational environments. Following the publication of the results of the international PISA study, 6,918 proposals for the provision of all-day schooling were approved in Germany between 2003 and August 2008. The government set aside just under 3 billion euros to support these initiatives within the framework of an investment program designed to further education and daycare (Investitionsprogramm Zukunft Bildung und Betreuung – IZBB) that is due to run until the end of 2009 (see Bundesministerium für Bildung und Forschung, 2008).

With all this time students spend in schools, cost and functionality should not be the prime concerns in school building. Esthetics should be given more weight in planning buildings where we spent thousands of hours. Not everything that is functional and technically well equipped, is also esthetic and conducive to well-being.

Furthermore, it is an ethical imperative in democracies that people with disabilities should be able to access, explore, and use public buildings – and therefore also schools – without help by others (cf. Day & Dieckmann, 1995).

2.3.7.1 The Site: Location, Features, and Access

With the decision to build a school, the challenge of finding an appropriate site arises. This is usually the task of the school board and county or municipal authorities, and they will select a site from properties on the market or already owned by the respective community.

Here, conflicts and contradictions can arise between "educational requirements and planning traditions" (Dreier et al., 1999 p. 87). School planning is a complex process in which the concerns of the different parties involved often do not coincide: School authorities and architects have different ideas and set priorities different from those of teachers or parents of the children who will attend the school. Not only the different views of planners and users, but also the specific local conditions as well as the economic resources of the community in question can cause problems. Only very few such cases will have simple solutions; all parties involved will have to compromise.

The number of laws and regulations, DIN norms (German Industry Norms) and standards as well as ordinances for accident prevention is enormous, and they often have the deplorable effect of constraining "educational inventiveness" (Faust-Siehl et al., 1996, p. 126). An example: "For school buildings and the associated open areas such as school yard, physical education areas, and green spaces, but not including areas designated for sports, the area required is approximately 20 square meters per student. Only in exceptional cases, such as for schools in already developed areas, a lower area standard is acceptable." (Ministry of Culture, 1996, N. 6 298).

Standard program regulations for classrooms provide area requirements of 2–2.5 square meters (21–27 square feet) per student. But this is only meaningful under the assumption that the children spend most of their time seated at their tables (Faust-Siehl et al., 1996, p. 127). It still seems that not everyone knows that especially small children need sufficient room to move, not only to prevent posture problems, but also to be able to concentrate.

Our inquiries suggest that architects have no say in the choice of site and the size of classrooms, and are only occasionally asked to comment on the selection of the site. Rather, the architect is expected to adapt the design to the given site. It is therefore hard to argue with architects' demands such as "in site selection, the political decision makers should develop a better problem awareness" (P. Busmann, personal communication, August 12, 1999) or "next time, a site should be chosen that is not so exposed but better protected from emissions" (R. Bingen, personal communication, July 15, 1999).

To avoid selection of a problematic site from the very start, the following questions should be discussed by the responsible decision makers:

- Are the features of the site appropriate?
- Will the school be easy to integrate into the village or urban neighborhood on this site?
- What about noise: Are there nearby airports, railway stations, highways or freeways?
- Will the senses of all affected parties be stimulated or rather affected negatively by the surrounding environment?

With respect to location, the site should be easy to access by means of public transportation and other vehicles. It is considered ideal to place the school near the center of the town or village; this will provide the best integration into the community. Also, such a location would be preferable for a more universal use of the school as an educational center by adults or as a recreation area for children during their free time.

The site should be large enough to absorb noise or pollution from nearby sources, if this cannot be avoided altogether. It should not be in a location susceptible to flooding. It should have some fertile ground to allow various outdoor uses such as a school garden or a pond.

Direct connection to an existing residential area is quite important to guarantee adequate integration with, and opening of the school to the community, for other activities throughout the day. Children need such integration to avoid feeling that they are being exiled. During the seventies, the prevailing trend was to locate entire school complexes outside of town, because of the increased area requirements. But why? Children attend school for nine years at least, so why should that institution not be integrated into the mainstream of life? Is it necessary to place schools somewhere on the outskirts?

2.3.7.2 Finding the Right Architect

What is a good architect like, and how can one be found? Certainly, this is not a simple task. There is a long list of desirable characteristics, and the expectations for the expert are demanding. Pros and cons of the architects competing for a project must be weighed carefully, and above all, the goal of realizing the new school project with its specific requirements and desirable features should not be lost from sight. “Of course, one would wish for a smart building expert full of ideas, who understands how to translate the purpose of the school, the potential of education, into a functionally and esthetically convincing form, one with which children, parents, and teachers can identify" (Dreier et al., 1999, p. 149).

The architect should not be one who tries to realize his or her own preferences by all means. The architect's task, as an advocate on behalf of students, parents, and teachers, is to create a solution that corresponds to their expectations and needs. From the moment of his or her appointment, the architect should be seen as a partner who has to fulfill a contract. To achieve this, the architect must be willing and able to engage in conversations with all parties concerned. This, then are the criteria for a good architect – but how to find one who answers this description? Rotraut Walden and I proceeded as follows (see also Walden & Borrelbach, 2012):

- We contacted architectural magazines with inquiries for new educational projects;
- We then wrote or talked to architects who had been working in an innovative and holistic manner, and made a selection according to criteria for schools of the future (Walden, 2000);
- Finally, we visited selected projects.

2.3.7.3 Architectural Competitions

Another possibility would be to make inquiries regarding architects with school projects that are currently underway. But if one wishes to be able to choose between different concepts and solution ideas, the best approach is to run an architectural competition. There are several advantages to doing this. One of the main reasons is the opportunity to select the most appropriate solution among many design proposals, at a relatively low cost. The prize for first place rarely exceeds 13,000 Euro. Another benefit is that a competition makes the entire community aware of the project, and ignites interest not only among the various agencies directly involved – school board, planning and permitting agencies – but also among teachers, parents, students and the media.

Competitions allow both young up-and-coming architects and established firms to participate with their designs. While earlier, commissions for all public buildings had to be determined as a result of competitions, the new European Union regulations no longer require this. And as a result of the large number of entries for competitions that now must be open to architects in all EU countries, competition sponsors have begun to only send entry invitations to offices that can demonstrate that they have previously completed projects of a similar size and nature or otherwise prove that their offices have the capability to successfully carry out such projects. The exception, of course are invited competitions which restrict participation to selected architects, excluding younger, little-known firms. Those rarely would have an opportunity to design larger public projects if it weren't for the chance of becoming known for a successful competition entry.

On the other hand there is no guarantee of achieving a better and more educationally appropriate school through a competition. The reason is that competition participants necessarily have no direct relationship to the client and therefore no discussion partner. Requirements and expectations for competitions are often expressed in a general and sparse manner. This may result in solutions that may be conceived to be attractive and even functional but do not achieve the pedagogical value desired by educators and appropriate to the specific location.

It can also become a problem if some competition jurors have little or no pedagogical expertise and therefore may be unable to judge whether a concept will be appropriate for children and conducive to learning. In addition, if the jury must review dozens of designs in a single day, it may be difficult to maintain adequate an overview so as to make a good decision.

Finally, how much of an influence or opportunity to participate does the school or do individual citizen have once the jury has made its decision? There should be provisions for adequate participation by educators, parents, and students, that is, the people affected by the decisions.

This question may appear to be a rhetorical one for many architects who have won first prize in a competition only to see the commission go to a different firm. And the negotiations for the further development of a winning concept often lead to compromises and a very different solution in the end. But these negotiations should provide for adequate participation by future users.

2.3.7.4 Plans, Decisions, Regulations

School construction projects are commissioned by contract, sometimes to the winners of a competition. Experts influencing this decision include landscape architects, representatives of the government departments responsible for education at the community, state, and federal levels, members and advisers of the school boards, environmental protection agencies, representatives of the churches, and other guests, who review the proposed plan and its adequacy.

The sponsor of a competition is the local agency – in most cases the city – and there is an independent jury consisting of two kinds of experts: "professional" (that is, architectural) jurors and "subject" experts appropriate to the nature of the project. Decisions are made on the basis of criteria, mutually agreed upon ahead of time. Preliminary plan reviews are carried out by the municipal administration, the planning department, the building permission department, public works, environmental protection department, church representatives and others. Competition winners are decided by the jury, but the acceptance of the final plan rests with the local authorities. If the commission is not the result of a competition, those authorities – usually a committee of school board members, parent representatives, and municipal government representatives – will make the decision.

The architect must follow governmental (both federal and state) regulations that are very detailed and complex, pertaining to construction, planning and zoning regulations, workplace regulations, and recommendations for school construction. Accident prevention ordinances and DIN (German Industry Norm) standards for issues like adequate lighting, space allocation for playgrounds, construction safety, and so on must be considered. If any such governmental regulations are violated in the design and construction of a school building, the architect may be fully liable for any damages resulting from accidents or mishaps; their liability insurance will not cover damages in such cases.

2.3.7.5 The School at the Intersection Between Architecture and Education

There are simple solutions and ready-made concepts available for architects and client agencies for schools: demand-oriented buildings, cost-effective construction methods. In the case of additions and renovations where visual compatibility is a primary concern, simple adherence to the existing structure will ease decisions. Obviously, attention to design is present in such cases; decision makers and regulation agencies point out the importance of the harmonious completion of the complex and its careful integration into the overall urban structure. In this way, the outer appearance of the project can be fine-tuned.

However, from an educational point of view, the interior of the building is of greater importance. The rooms and their dimensions and proportions, flooring materials, ceiling treatment and fenestration, walls and furnishings create an individual profile that significantly influences the success of the educational process. Above all, there must be sufficient space to accommodate the appropriate furnishings and equipment of classrooms to make them a viable place for learning, experience, and life.

It is by now an accepted expectation for school designers to embrace these needs, the concerns and life situations of today’s children. This also applies to specialty rooms, staircases, hallways, assembly and multipurpose rooms, entry areas, and courtyards. Children should not just be seen as temporary users, but as actual temporary owners and residents: These spaces will be their homes and workplaces. The architect’s goal must be to achieve wellbeing, comfort, and acceptance of the building by the children.

This will result in joyful learning, willingness to achieve, and successful learning processes. To achieve this, it is necessary to listen, to communicate, and to understand the different educational work styles, the unfolding of learning processes, and a kind of instruction that opens up to different forms of participation while paying due attention to the individual child's personality.

It should not be overlooked that the different basic types of school schematics each have their specific advantages and disadvantages that influence the aspects mentioned above. In the common corridor scheme, classrooms are lined up along hallways through which crowds of children move and where there is rarely any room for encounter and communication. Wherever one might be in such a school, it is hard to avoid a feeling of "being in the way." The sole advantage of these solutions is their rationality: They are easy to insert into existing street patterns, to enlarge, and to combine into larger complexes. But they do not meet the needs of contemporary child-friendly education, and rarely result in an appealing overall form.

In contrast, schools organized around an atrium or central hall allow for a diversified architecture. There are limitless variations ranging from circular patterns, star or lentil-shaped arrangements to combinations of rectangular blocks with circular pods. The center of such schemes is the assembly hall which serves common events as well as extensions of the classrooms during regular class hours. This creates a meeting space which "does not merely permit but actually provokes social encounters and togetherness" (Dreier et al., 1999, p. 50).

A special form of the central hall scheme is the honeycomb pattern, which provides a good compromise between openness and closed arrangements. The classrooms are polygonal in plan, which facilitates many different forms of utilization with lecture hall seating or seating in the round, individual workspaces and corners for special functions and workshops, as well as combinations of these options. These honeycomb plans offer a spatial concept that supports variable social groupings, no longer tied to the traditional classroom as the dominant structural element.

Completely new plans, so-called free forms, can arise from the combination of several of the basic types mentioned. The ideal would be patterns that combine the communication opportunities of the central hall school with the transparency and flexibility of use of the large one-space school (workshop) and the retreat possibilities of the traditional classroom (cf. Dreier et al., 1999).

The question of how to design schools to serve and support these processes and meet these educational expectations will be the easier to answer for architects the more they establish and maintain contact with teachers and students and seek to understand their needs. Both sides should know more about the respective other, with architects and educators working closer together, seeking common ground without fear of contact. This will be the guiding principle for the years to come as well: The central concern is the student; the driving force are the educational principles and the requirements of contemporary learning processes. These are, of course, subject to constant change and evolution. Architects must maintain pedagogical sensitivity – run-of-the mill solutions are no longer called for.

Our interviews confirmed how much architects are beginning to engage these expectations and seek to acquire factual knowledge, methodological skills, and social sensitivity in school matters. School planners don't merely hold superficial discussions, but carry out intense surveys of students, teachers, parent representatives, and sponsoring agencies with sincere curiosity and to their personal gain.

One impressive example was the architect Peter Busmann, who intervened in the school for students with special needs in Wiehl-Oberbantenberg and found a solution for the swimming pool that avoids the use of a crane to lift persons with disabilities into the water. He created a swimming landscape with a gently sloping "beach" to allow users to enter the pool in waterproof wheelchairs, move around on their own, and seek out their own appropriate water depths and areas. As a result, these children felt much more comfortable – and the pool lost its clinical rectangular shape. Busmann had not only visited the school while planning, but taken along his bathing trunks and organized a "working swim." Becoming personally involved and affected in this way, he found a new solution he considered more in tune with human dignity.

2.3.7.6 Forms of Participation

During the 1960s, there were impulses in architecture to break up the rigid rectangle or square of classrooms by adding adjacent spaces that would allow small group work or other differentiating activities. The goal was to achieve a nearby stimulating learning environment that offered a "home" for the children and a place for the class to retreat to and engage in new forms of instruction. To achieve this, ideas and suggestions from educators and students had to be included. Only such a process will bring about the desired identification of the users with classrooms and the school buildings.

Frequent targets for criticism in schools are the long, monotonous, and narrow hallways. It should be possible to use the hallways as niches, exhibition areas, or even as external areas for differentiated instruction methods. The hallway should not only be a space for movement but also as an instructional and communication area. With the decline in the number of students that is suggested by

demographic studies, there will be an excess of rooms in many schools. This will turn into a test of the school's structure: "Schools of the future" will also require remodelling work in existing, otherwise still functional schools. This, however, could be difficult to finance because the authorities might have trouble recognizing the need for it in the face of apparently reduced demand. Parents and students can exert some pressure, though. Their suggestions and request are often focused on redesigning the school yard or other outside areas: In meetings, one can often hear loud calls such as "We want a school garden!" or "We want a pond!" Such request must be considered.
Participation means working together. It can involve teachers, parents, students, but also supporting institutions. Distinctions must be made between

- participation during the planning and design phase;
- participation during the construction phase; and
- participation after completion and occupation, during the use phase.

While users today yearn for participation, individual users do not have a voice during the planning and design phase. Usually, the architect delivers a plan to the client organization, and construction begins. Likewise, user participation during the construction phase is not currently very common in Germany. One notable, well-publicized, and positive exception should be mentioned here: At the Protestant Comprehensive School Gelsenkirchen-Bismarck, students can build their school houses themselves, with appropriate professional guidance. This approach has only positive aspects, since on the one hand the children receive training in construction crafts and on the other hand develop a positive identification with the building. From participation springs responsibility, because people take care of what they own (Kleinau-Metzler, 2001, p. 741). There are many examples of participation after completion of construction. In most cases, this involves special project weeks or the regular art classes, and ranges from exterior beautification to classroom decoration.

Participation by Students
Students can make contributions in many areas with their creativity and ability to work. Beginning with the outside areas, the children might plan, install, and maintain a school garden. There could be flower beds or herb gardens. The entrance area can be decorated with pictures or other items made by the students in their art classes. It will be more difficult to add student contributions to the school building itself, but part of the facade, or its color decoration, for example in the area used for breaks during the school day, might be designed by children.

Inside the school there are many possibilities, including:

- decorating the hallways with pictures;
- decorating classrooms with pictures and plants;
- enhancements of specialty or multifunctional spaces.

Participation by Teachers
The extent of participation by teachers depends very much on individual teachers and their personalities. A project should be presented to the faculty by the architect and his coworkers during the planning phase. The architect could point out variations still possible within the constraints of structural safety, the official program for spaces, and building regulations. The discussion can uncover aspects for improvement of daily use processes. This might involve connecting doors, dividing walls, the width of hallways, and the placement of blackboards or installation of cabinets and showcases. Meetings with the entire faculty serve to present and develop overall concepts that guide the design of "our" school. It is customary in such cases to appoint teachers with a particular interest in this to special committees to get further involved in the development and design of the building. It has also proved to be meaningful to add representatives of students and parents to such committees. The school's principal, the governing body, and representatives of the architect's office would be advisory members.

There is a general provision regarding public buildings in Germany, which requires that a certain percentage of the total building budget be set aside for art ("art in buildings" funds). Teachers would appreciate it if the funds thus designated for artwork within any given project could be held in reserve for the developing wish list of the various users following occupancy. Fountains and sculptures contributed by appointed artists often turn out not to be very meaningful and possibly even misplaced, because the children attending the school have no personal relationship and access to these works. Pointing out that "unspeakable mischief is frequently committed under this heading ["art in buildings"]," Rittelmeyer (1999, p. 2) also suggests that the school community should be included in the decision-making process about such funds and that it might be beneficial to extend the time line for spending such funds and to spend it with competent advice. Contributions by teachers can be quite important, especially when they concern the design of entrance areas, exhibition areas, showcases, space dividers, ceiling design, and the provisions for rest and play areas outside. Suggestions for bicycle tracks, school gardens, orchard meadows, ponds or the use of shrubbery instead of fences for the demarcation of the school grounds, also often come from teachers.

Participation by Parents and Sponsoring Organizations
The parent advisory council will contribute suggestions during various phases of a planned school project, with the principal and the planning committee present. This often includes proposals for parents to take part in the design and actual construction of the school yard. Parents also have an interest in the design of bus stops and loading areas. Even in my own village we have seen fathers of school children wanting to construct bus stop shelters. Furthermore, the wish list on the part of parents may include stage props for school plays, equipment for workgroups, choir, guitar lessons, or dance events. Suggestions for planting indigenous trees and plants instead of exotic varieties should also be taken seriously. If such proposals are not brought up too late, they will be appreciated by the school and can even help reduce costs. It is important to make sure that proposals are well documented and directed to the proper party responsible for acting on them. The school's friends' association – whose members usually consist of parents, alumni, other after-hours users of school facilities, and others who feel an affinity to the school – will often address and take responsibility for specific items such as the financing of playground and exercise equipment, or a stage for the assembly hall. These are items that often cannot be considered in the official budget for the school. But other cultural associations and agencies of the community will become active with respect to the designated use of the assembly hall, the gymnasium, multipurpose rooms, or media center. These concerns will be taken into consideration and represented by the official client organization. There is, of course, always a danger that all these contributions lead to a confusion of opinions and requests. Here it is important for the architect to retain control of the strategic center and to remind participants of the need to trim the wish list as needed. The responsible parties must make careful distinctions between what is desirable, educationally valuable, financially viable, practically feasible, and responsible.

2.3.7.7 Open Instruction

Though the individual constitutions of Germany' federal states clearly articulate educational goals, calling for the development of individual judgment, responsible action and thinking, and the development of the capability for service to family, society, country, and the community of countries (local – national – international – global), the actual school experience is still dominated by the traditional teacher-centered instruction and rigid instruction phases. These are instructional methods that have long been considered problematic. Titles from contemporary educational literature such as "Surviving school" (Die Schule Überleben, Herndon, 1972) or "What is a humane school" (Was ist eine humane Schule?, von

Hentig, 1976) have signaled widespread discontent and discomfort for some time. Standard instruction consists mainly of subject-specific content, the mandate to “proceed with the material” designated for any particular grade by the official curricula, and the presentation of facts and results. The fixed 45-minute rhythm leaves little time for additional investigation and discussion of questions, conflicts, or problems arising from social, political, and economical areas of interest (cf. Bönsch, 1979). There is likewise little time for the development of social relationships among students and between students and teachers. Learning to achieve a good record (as measured in grades) takes precedence. Learning difficulties can rarely be taken into consideration; “poor” students have to just accept their inability to meet academic expectations, and the consequences for their shortcomings.

“As much as possible, instruction should lead to tangible and demonstrable results with which one can play or work, outcomes that are of immediate as well as future usefulness for the students” (Meyer, 1989, p. 402; ref. 1999). Children can learn much through activities which throw a new light onto the entire instructional process. Activity-oriented teaching means a “holistic and student-oriented instruction in which the action results that have been agreed upon between teacher and student guide the organization of the instructional process and bring the work of students’ head and hand work into a balanced relationship” (ibid., p. 402). This makes the instructional process more open, more interesting and engaging, but also more risky. Both students and teachers can identify with this kind of teaching. It leads easily to guiding the students towards an attitude of respect for nature and the environment, as well as toward creation and creator.

Student Personality and Team Work

The world of children has seen dramatic changes in Germany within the past decade or so. More than 50% of children grow up as an only child, without siblings, more than 2 million children live with only one parent, and the number of children with a migration background is rising steadily. In addition, education (in the traditional sense) hardly takes place anymore in many families. The PlayStation or other modern media are the substitute for parent attention. The number of incidents of violence and bullying of classmates in schools is rising.

Precisely for these reasons, it is necessary that new concepts like open instruction are accepted and applied by teachers. The first step in this is rethinking on the part of teachers. They must be ready to give up their monopoly position and change their role towards that of helper and advisor. At the same time, students are given a greater right of participation and responsibility. The guiding principle must be that students and teachers bring their intentions and interests into the discussion and then decide together what the rules of the game and their respective obligations will be. A socially integrative leadership style in which teachers comment upon and explain their own actions and behavior, accept suggestions and in turn suggest alternative solutions, encourage initiative and support team work, will contribute to an open instruction as much as the avoidance of a fear-inducing classroom climate and the reduction of performance pressures. Corresponding to the teacher's behavior in support of communication, students will develop independence, curiosity, and readiness to ask questions as well as creativity and productivity. With all this increased freedom regarding instructional approach and content, it is important to remember that teaching is, after all, a process aiming at the development of knowledge and skills, which cannot completely do without a curriculum. Open instruction must therefore seek a synthesis between curricular expectations and the learning interests, ideas, and concerns of students and teachers. The process will thus constantly exhibit possibilities for choosing alternative approaches to reach agreed-upon goals; the predetermined learning objectives can be reached by different roads and learning experiences.

The achievement of key qualifications proceeds in learning processes that are aimed at community. The individual student personality grows in learning experiences that foster community; participation and partnership are part of this. The students organize self-determined learning, distribute specific tasks to individual students, set time frames, and form study groups. In all this, individual preferences, interests, and talents play a significant role. Learning steps are mastered in teams, in which interim results are documented, and further steps to search for needed information agreed upon. This kind of group learning is especially beneficial if the individual results are then presented to the whole group. This promotes the development of presentation and social skills. The different teams come to regard themselves as partnerships and together represent their mission, their successes and results, and share their feelings of achievement. They also articulate their learning difficulties and different approaches to overcome them; suggestions for different strategies and variations occur in the same reflective movement. For this kind of instructional process, the possibility of a quick rearrangement of furniture is critical, promoted by the space itself suggesting such an ease of regrouping. Further forms of open instruction promise correspondingly increased benefits.

2.3.7.8 Learning Stations and Learning Workshops

The vast field of approaches to open instruction and work cannot be covered here for reasons of space. Many of today's innovative efforts with respect to learning stations and learning streets take up ideas and approaches first spearheaded by Célestin Freinet and Helen Parkhurst (see the descriptions of their work on pp. 54–56).

2.3.7.9 Opportunities for Contemporary Instruction

Schools have specific missions related to their location, their neighborhood, their community, and their region. With input from parents and student representatives, teachers develop their guidelines, and articulate them in their teachers' conference decisions as the basis for their programs. The aim is the recognition of current and future needs. Societal changes call for corresponding instructional change. Student competence must be strengthened simultaneously with regard to the development of their personality, social skills, subject knowledge, and procedural skills, on the basis of independent self-activated work. It is almost superfluous to mention that the revision of curricula is long overdue. The relevance of thematic content is as critical as their productivity and transferability. It is essential to have, from time to time, a role reversal of students and teachers. Especially with respect to new media technology, the young ones are often considered more expert than their elders – why should this knowledge not be put to use? Students teaching students, possibly a quite effective and pleasant learning process!

2.3.8 Perspectives for the Future

The school's mission will have to respect certain fixed parameters. Instruction and life in schools will have to focus upon student personalities and support their development. Caring attention, encouragement, strengthening of self-confidence and mutual trust, willingness to achieve, and motivation are valid and timeless factors. There will be a demand for media competence growing from independent involvement and personal interest. Instructional content will continue to be dominated by subject areas but these will overlap and be presented in their mutual connection. Teachers will retreat from their dominant role with respect to the direct involvement of students with the subject, but not in their task of preparing and organizing the program. The teacher will be more like a theater or film director, but also co-learner, advisor, and companion. Teachers will delegate many aspects of the instructional process to students and thereby strengthen the social structure of the class and learning groups. Integration and support work will be matters of course. The continuing mission will be, as articulated, for example, in the Regulation for elementary schools in Rhineland-Palatinate (Schulordnung §8(2) and §9(2)) as well as in the state's superseding School mandate (cf. Schulordnung , p.10): "Students are entitled to offer suggestions for the instruction and for the unfolding of the daily life in schools." If this is taken to heart, the school will not get onto a wrong track.

Individuals and society are dependent upon one another. Obstacles to their complementary mutual development must be overcome. This is especially true for obstacles arising from the spatial design, space allocation, and spatial opportunities offered by the school, because of the long life of building and building parts. Open school landscapes in different wings, areas with learning workshops and learning stations, "classless" arrangements, with specialty labs and libraries, archives, and consultation rooms are conceivable answers to these obstacles.

2.3.9 Summary

Concern with the design of schools is not a recent phenomenon. As early as a hundred years ago, educators began to study the effect of school buildings on children. This chapter has tried to present the changes and recognizable differences not only with respect to the visual appearance of schools but also the learning content and learning atmosphere. School construction has been influenced by temporal factors and societal change. Also explained were the efforts of some representatives of reform pedagogy to connect their educational theories with ideas for school house design. One regrettable finding is the fact that the desires and concerns of students with respect to school appearance organization were not considered in earlier times. A comfortable learning atmosphere does not have to be expensive; small details can produce significant improvements, but until about 40 years ago, such viewpoints hardly received any attention. Many factors influence today's school planning, which is significantly different from that of earlier periods. The design is often developed on the basis of an educational concept established early in the process. The site receives more attention since it will influence the overall exterior planning. Location and site features must be evaluated in view of the intended use. The connection to a residential area is another critical aspect for the successful integration of the school into the community. To achieve all these objectives, it is vital first of all to find the right architect. The architect's task is to act as the users' advocate in designing a school building that will answer their concerns and needs as much as possible. Architectural competitions are one way of identifying a suitable architect; they are not only cost-effective but also open the door for younger and not yet well-known architectural firms. While the architect must observe many governmental regulations, guidelines, and standards in designing the building, it is also vital to include the future users in the planning process. Doing this will not only prevent costly planning mistakes but also facilitate the process of users' identification with the school building. This is the best precondition for user acceptance of the new project; only then will the users be able to feel at home in the school.

References

Asztalos, A. (1981). Schule kaputt? Warum in Schulen vieles zerstört wird und was wir dagegen tun können. [School's broken? Why there is so much destruction in schools and what we can do about it]. Hanover: Niedersächsischer Kultusminister.

Böhm, W., & Flores D'Arcais, G. (Eds.). (1979). Die italienische Pädagogik des 20. Jahrhunderts [Italian pedagogics of the 20th century]. Stuttgart: Klett-Cotta.

Bönsch, M. (1979). Offener Unterricht. Curriculare, kommunikative und unterrichtsorganisatorische Aspekte [Open instruction: Curriculum, communication, and organizational aspects]. Berlin: Schroedel.

Budde, F., & Theil, H.W. (1969). Schulen: Handbuch für die Planung und Durchführung von Schulbauten. [Schools: Manual for the planning and implementation of school buildings]. München: Callwey.

Bundesministerium für Bildung und Forschung. (2008). Ganztagsschulen – das Investitionsprogramm "Zukunft Bildung und Betreuung" (IZBB) 2003–2009 [All-day schools – the investment program "The Future of Education and Daycare" 2003–2009]. Retrieved from http:// www.ganztagsschulen.org/_downloads/BMBF_Grafiken08.pdf on September 27, 2008.

Dannhäuser, A. (1997). Erlebte Schulgeschichte 1939 bis 1955. Bayrische Lehrerinnen und Lehrerberichten. [School history from 1939 to 1955 as experienced: Bavarian teachers report.] Bad Heilbrunn: Julius Klinkhardt

Day, P., & Dieckmann, P. (1995). Stadtqualität – nicht nur für junge Gesunde. [Urban quality – not only for the young and healthy]. In A.G. Keul (Ed.), Wohlbefinden in der Stadt. Umwelt- und gesundheitspsychologische Perspektiven [Well-being in the city. Environmental and health- psychological perspectives] (pp. 198–233). Weinheim: PVU.

Dietrich, I. (1995). Handbuch Freinet Pädagogik. Eine praxisbezogene Einführung. [Manual on Freinet pedagogy: A practice-oriented introduction.]. Weinheim: Beltz.

Dreier, A., Kucharz, D., Ramseger, J., & Sörensen, B. (1999). Grundschulen planen, bauen, neu gestalten. Empfehlungen für kindgerechte Lernumwelten (Jubiläumsband zum dreißigjährigen Bestehen des Grundschulverbandes) [Planning, building, and renovating elementary schools. Recommendations for learning environments suitable for children (Publication celebrating the 30th anniversary of the Elementary School Association)]. Frankfurt am Main: Arbeitskreis Grundschule e.V.

Engel, O., & Dahlmann, J. (2001). Pädagogische Architektur [Educational Architecture]. Unpublished thesis submitted to the State Examination Office for First State Examinations at Schools in Cologne as part of the first state examination for special needs education. University of Cologne, Germany.

Engelmann, S. (1905). Handbuch des bayrischen Volksschulrechtes [Handbook of Bavarian school law]. Munich: Bayrischer Schulbuchverlag.

Faust-Siehl, G., Garlichs, A., Ramseger, J., Schwarz, H., & Warm, U. (1996). Die Zukunft beginnt in der Grundschule. Empfehlungen zur Neugestaltung der Primarstufe [The future begins in elementary school. Recommendations for the reorganization of elementary education]. Reinbek: Rowohlt.

Flagge, I. (1996). Eine Architektur für die Sinne. Busmann + Haberer. [An architecture for the senses. Busmann + Haberer]. Berlin: Verlag für Architektur und technische Wissenschaften. Goldstein, A.P. (1996). The psychology of vandalism. New York: Plenum.

Gump, P.V. (1978). School environments. In I. Altman & J.F. Wohlwill (Eds.), Children and the environment. New York: Plenum.

Hegele, I. (1996). Lernziel: Stationenarbeit. Eine neue Form des offenen Unterrichts. [Learning goal: Station learning. A new form of open instruction] Weinheim: Beltz. Heimatkalender Kreis Bitburg-Prüm (1965).

Herrlitz, H., Hopf, W., & Titze, H. (1981). Deutsche Schulgeschichte von 1800 bis zur Gegenwart. Eine Einführung. [History of schools in Germany from 1800 to the present. An introduction]. Regensburg: Athenäum.

Hübner, P., & Beierlorzer, H. (2005). Kinder bauen ihre Schule. Evangelische Gesamtschule Gelsenkirchen. [Children build their school: The Protestant Comprehensive School in Gelsenkirchen.] Stuttgart: Karl Krämer.

Kähler, G. (2004). "... dass der Mensch was lernen muss". Staat, Schule, Schulhaus – ein historischer Rückblick. [„... that a person should learn something." State, school, and schoolhouse – a historical retrospective.] In Wüstenrot Stiftung (Ed.), Schulen in Deutschland. Neubau und Revitalisierung [Schools in Germany: New Buildings and Revitalization] (pp. 12–36). Stuttgart: Krämer.

Key, E. (1992). Das Jahrhundert des Kindes. Studien. [The century of the child: Studies]. Weinheim: Beltz. (Original edition published 1900/1902).

Kleinau-Metzler, D. (2001). Blick über den Zaun. Vital erziehen. Ein Porträt der Evangelischen Gesamtschule Gelsenkirchen. [A look over the fence: Educating with vitality. A portrait of the Protestant Comprehensive School Gelsenkirchen]. Erziehungskunst, 6, 739–743.

Kükelhaus, H. (1971). Organismus und Technik. Gegen die Zerstörung der menschlichen Wahrnehmung. [Organism and technology. Against the destruction of human perception.] Frankfurt am Main: Fischer.

Lederer, A., Pieper, A., & Kötz, R. (2004). Schulen in Deutschland – ein Situationsbericht zu Schulbau, Schulsanierung und Schulschließung. [Schools in Germany – A report on the state of school building, renovation, and school closings]. In Wüstenrot Stiftung (Ed.). Schulen in Deutschland. Neubau und Revitalisierung [Schools in Germany: New Buildings and Revitalization] (pp. 36–68). Stuttgart: Krämer.

Meyer, H. (1989). Unterrichtsmethoden II: Praxisband [Instructional methods II: Practice] (2nd ed.). Frankfurt am Main: Cornelsen.

Meyer, H. (1999). Unterrichtsmethoden II: Praxisband. [Instructional methods II: Practice] (11th ed.). Frankfurt am Main: Cornelsen Scriptor.

Kultusministerium Rheinland-Pfalz [Ministry of Culture] (1996). Amtsblatt [Official publication] Nr. 6, p. 298.

Mitter, W. (1994). Bildung und Erziehung. Themenheft: Pädagogik und Architektur. [Special issue: Education and architecture] Köln: Böhlau.

Montessori, M. (1909). Il metodo della pedagogica scientifica applicato all' educazione infantilenelle casa dei bambini. [The method of scientific pedagogy applied to the education of young children in the house of the children]. Lapi: Città di Castello.

Montessori, M. (1927). Selbsttätige Erziehung im frühen Kindesalter. [Self-education in early childhood] Stuttgart: Julius Hoffmann.

Oelkers, J. (1996). Reformpädagogik: Eine kritische Dogmengeschichte. [Reform pedagogy: A critical history of the dogmas] Weinheim: Juventa.

Pädagogisches Zentrum Rheinland-Pfalz (1997). PZ Information 2/1997.

Petersen, P. (1927). Der Jena-Plan einer freien allgemeinen Volksschule. [The Jena plan for a free general elementary school] Weinheim: Beltz.

Petersen, P. (1930–1934). Der große Jena-Plan. Schulleben und Unterricht einer freien Volksschule. Das gestaltende Schaffen. Die Praxis der Schulen nach dem Jena-Plan. [The greater Jena plan. Life and instruction in a free elementary school. Creative activity. The practice of schools according to the Jena plan]. Weinheim: Beltz.

Raab, R. (1982). Die Waldorfschule baut. Die Architektur der Waldorfschulen 1920–1980. [The Waldorf School builds. The Architecture of Waldorf Schools 1920–1980]. Stuttgart: Freies Geistesleben.

Rittelmeyer, C. (1994). Schulbauten positiv gestalten: Wie Schüler Farben und Formen erleben. [Positive school design: How pupils experience color and form.] Wiesbaden: Bauverlag.

Rolff, H.G., & Zimmermann, P. (1990). Kindheit im Wandel. Eine Einführung in die Sozialisation im Kindesalter. [Changing childhood. An introduction to childhood socialization.] Weinheim: Beltz.

Scheibe, W. (1999). Die reformpädagogische Bewegung 1900–1932. Eine einführende Darstellung. [The reform pedagogy movement 1900–1932. An introduction] Weinheim: Beltz.

Schulchronik: 100 Jahre Schule Trier-West [School chronicle: School Trier-West, 100 Years]. (1976). Trier: Raab.

Steiner, H. (1999). Integration und Raum. Konzepte der Raumgestaltung für integrative Schulen. [Integration and space. Spatial design concepts for integrative schools.] Dortmund: Borgmann.

Steuerwald, M. (1975, February 14). Integrierte Gesamtschule Hannover-Roderbruch [Comprehensive School Hanover-Roderbruch]. Bauwelt (7), 197–206.

Verband alleinerziehender Mütter und Väter, Bundesverband e.V. (Ed.). (2004). Informationen für Einelternfamilien [Information for single-parent families], Nr. 3, July/August/September. Retrieved from http://www.vamv.de/DOCs/einelterninfo_3_04.rtf on September 12, 2006.

Wagner, G. (1967). Lehranstalt und Lehrbetrieb als Gestaltungskräfte des Schulhauses. [Teaching institution and teaching operation as design determinants of the schoolhouse.] Saar: Dudeweiler.

Walden, R., & Borrelbach, S. (2012). Schulen der Zukunft. Gestaltungsvorschläge der Architekturpsychologie. [Schools of the Future. Design Proposals from Architectural Psychology] (7th ed.). Heidelberg: Asanger.

Walden, R. (2000, September). Die Auswirkungen von Selbstgestaltungen in Schulgebäuden auf Wohlbefinden, Lern- und Sozialverhalten. [The effects of self-styling in schools on wellbeing, learning, and social behavior]. Presentation given at the conference of the German Psychology Association, Jena, Germany.

3 The School of the Future: Conditions and Processes – Contributions of Architectural Psychology

Rotraut Walden

3.1 Requirements and Wish List

The School of the Future "will possibly never be achieved, because something will always be amiss: Sometimes it may be the architecture, sometimes the teachers, at other times it may be the principal, or the students…" (Ernst Kasper, architect, Aachen, Germany, personal communication, July 24, 1999). Is this a fair assessment?

The essential features of the school of the future should be contributing to a positive educational quality of the learning environment. Children should be stimulated to engage in individual investigation and exploration through an appealing design of the spaces, with workshop-like classrooms and a variety of materials. This will create a variety of forms of learning. The environment should stimulate children's senses and provide the opportunity for a playful engagement and experience with the elements earth, water, fire, air. Active interaction with the environment can be achieved through creative activities. For this, too, a variety of materials should be made available. Surfaces and areas for presentation and exhibits should be present throughout the school. Building materials as well as equipment and furniture should be appealing.

The school should be a place not only for learning in the mornings, but one where children would want to stay for play with friends in their free time. It is therefore important that especially outside areas offer multiple opportunities for play and romping, with different surface materials and elevations, and areas equipped with play equipment.

Schools for all-day use pose different challenges to the architect. Spaces must be able to serve multiple purposes so as to offer the children opportunities for movement and exploration but also rest and retreat, both inside and outside.

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The school should be defined as a place for community, and the relationship between the spaces can do much to contribute to this. The architectural design determines the quality of the experience of community.

Of course, the school must accommodate children with disabilities; this is – where not already required by law – an ethical principle. A variety of disabilities should be taken into account. But wheelchair-accessible entrances, wide doors, handrails and walking aids, elevators as well as wheelchair-accessible restrooms simply must be present in any new school.

Schools should not only meet functional requirements but also have a variety of qualities of educational and esthetic nature (cf. Dreier, Kucharz, Ramseger, & Sörensen, 1999).

3.1.1 Psychological Processes

In schools as much as in any other environment, psychological processes can influence learning, teaching, and well-being of individuals in many positive and negative ways. Such processes include arousal, adaptation, stress, distraction, overload and fatigue, but also the effects of lighting, color, noise, heating, cooling, ventilation, and equipment and furnishing.

In spite of their potentially profound influence on the performance of students and teachers, these processes are often not acknowledged by the responsible parties. The task of creating a stimulating and successful learning environment is a daunting one because of the many people coming together in a school, all of whom have developed their own different subjective opinions about design, form, and color. This may make it seem nearly impossible to provide a perfect learning environment for everybody. But it is possible to suggest some general provisions that affect performance and perception of a pleasant learning environment in a positive way.

Such conditions include the generation of a medium level of stimulation, as well as the elimination (as much as possible) of factors causing stress and disturbance, that might eventually lead to distraction and fatigue through overexertion. If this can be achieved, a supportive learning environment can be within reach. But it must be emphasized that even a perfect learning environment does not by itself guarantee better learning results. Rather, it is one contributing factor among many others such as the students' cognitive ability, motivation and personality, as well as social conditions at home.

3.1.2 Spatial Perception

To perceive something is an active process. We don't only see an object, we also feel, smell, taste, and hear it (Guski, 2000). All our senses are involved. But sensory reception must be processed in the brain. This will then generate the overall understanding of the situation in time and space.

Every act of perception is accompanied by some expectational attitude, which on the one hand influences the understanding of the perceived situation, and on the other hand is itself the result of prior experiences. "Early perceptional imprints influence later perceptional habits" (Petermann & Menzel, 1997, p. 61. However, so far, solid evidence for this has been established only in animal studies). Humans see only a small part of an object in "sharp" focus. The larger the object, the more constrained the focus. We start by scanning the object with jerky eye movements to arrive at an overall impression. From the patterns of these visual eye movements, researchers learn which aspects are scrutinized with special attention (cf. ibid.). Depending on the object, the scanning movements can be monotonous or varied, orderly or chaotic. This in turn can be perceived as positive or negative, and in extreme cases as threatening. However, to date there are no research findings about what causes these different perceptions.

3.1.3 Sensory Perception of Architecture

Architecture acts on our senses in various ways. We all see spatial forms and colors, feel and smell building materials and surfaces, hear the sound of spaces, sense the warmth or coolness of the different materials. Beyond these familiar sensory perceptions, little thought has been devoted to sensations such as the sense of equilibrium (vestibular sense), of one's own movement (kinesthetic sense), and the various receptors for the sensation of our own bodily functions (somatovisceral senses), all of which are significantly involved in the perception of architecture.

We maintain an upright walking posture, more or less securely, in relation to different horizontal, vertical, or inclined spatial arrangements; our view passes over facades, and we undergo certain processes of tension and relaxation. Entering the new gymnasium for the first time, visiting the assembly hall in an ancient castle, or the barn of a farm, students receive impressions of architectural and spatial constellations that influence their reactions. Clearly, "seeing" a building or a room is not just a matter for the eyes but a combination of – at least – the visual, equilibrium, and kinesthetic senses (Rittelmeyer 1994, p. 16; cf. Guski 2000).

Rittelmeyer lists more aspects that are involved in the sensory perception of buildings. He explains how exterior senses react with inner sensations and lead to evaluative judgment. The young person experiencing architecture receives various stimuli of different strength, which generate arousal and information of a spatial and temporal nature that then begins to periodically and rhythmically influence feeling processes. It seems that in all forms of active spatial orientation, the human feature of upright standing and walking serves as the reference point for the evaluation of buildings, including schools (ibid., p. 16). The body stands in proportional relation to buildings and spaces, whether small or large, high or low, angled or rectangular, and to possible movement patterns. It can be fascinating to watch children take in a spatial interior and linger with their eyes at certain key features and orientation points. They are in the step by step process of forming a relationship with the space. "With head, heart, hands and feet" – Pestalozzi's motto contains the insight that the feet are a vital part of the body's sense of standpoint and equilibrium (Johann Heinrich Pestalozzi, 1746–1827).

These insights guide the design of Waldorf schools, which offer a feast for the eyes. One of their principal aims is the development of all senses. This manifests itself not only in the well thought out color scheme, but in the entire interior design and decoration down to the pleasant smell of beeswax candles and tables full of seasonal fruit. Nor is the sense of touch neglected: The diverse door handles invite touching as much as the various building materials one can find throughout the school. Plastic furniture cannot be found in any Waldorf school; light-colored wood furniture in diverse forms decorate the classrooms.

Brain research has established that the development of the various sensory centers in the brain depends on the stimulation of the respective senses. The decisive factor in this is active engagement with the environment, and this in turn depends on how interesting, pleasant, and meaningful that environment is perceived to be. Whether the architecture of a school is perceived as lively, dynamic, rigid, or relaxed seems to be primarily determined by the degree of stimulation of the vestibular, kinesthetic, and somatovisceral senses, as shown by Rittelmeyer's investigations. Different building forms seem to activate these senses in very different, specific ways. Rittelmeyer's results from interviews as well as his eye movement research can be summarized in the finding that angles in buildings seem to provoke and in extreme cases to irritate our sense of equilibrium (Rittelmeyer 1994, p. 34)

This may serve to highlight the role, in spatial perception, of upright posture and walk, one of the basic human properties rooted in the evolution of the species. Interesting in this connection is the dominant role of symmetry – or at least dynamic balance of building masses – throughout architectural history. On the other hand, certain experiences of challenge to our sense of equilibrium are not always to be seen as undesirable: This can be seen in children walking on stilts or balancing on handrails (Rittelmeyer 1994, pp. 32–33).

3.1.4 Spatial Conditions

A space is much more than four walls, floor, and ceiling. The spatial conditions that should be considered for human well-being include color scheme, lighting, heating, cooling and ventilation, acoustics, smells, and furnishings. All these aspects can significantly influence the sense of well-being and readiness to learn, and therefore also learning performance.

3.1.5 Children's Scale

Planning decisions regarding the dimensions of spaces, furniture, and equipment of schools must be to the scale of children, because "due to their anthropometric data, children perceive spaces differently from adults." (Hartmann, 1997, p. 81). This is derived from their average height, length of pace, arms' reach and height, the angle of vision, and body strength of children aged 5–14 years.

The height of light switches, wardrobe hooks, handrails for stairs, window sills, the rise and tread of stairs and steps, the height of furniture seats and tables as well as bathroom and kitchen equipment will have to conform to this children's scale; later on that for adolescents. This is necessary for reasons of health and safety, but there is also an important psychological aspect in that it promotes a sense of independence in children especially of preschool age who learn to reach light switches, door knobs, toys on shelves without the assistance of teachers. However, the rapid growth of children (cf. Nickel & Schmidt-Denter, 1988, p. 31) makes it difficult to determine the appropriate dimensional standards. If these are not already prescribed by norms, an approach might be taken of letting the measurements of the younger (5–10 year old) children guide the height of handrails, for example, and choosing the height of door openings, passages, and built-in cabinets, for example, according to the height of the oldest.

These aspects are at work in the school building as a whole and in individual classrooms. They affect students, teachers, and even parents, sometimes to the point of causing indisposition. But spaces do not affect everybody in the same way; the challenge is to make them at least acceptable to everybody's feelings. This is often not the case, especially in older school buildings. Some of these spatial conditions can be partially changed and improved by the users after occupancy. This very much depends on the commitment of teachers and the motivation of students. There is, of course, no general law to the effect that better spatial conditions also bring about better performance in all students. But many studies suggest that good spatial conditions exert a positive influence on well-being, performance, motivation, and social interaction among all involved (cf. Gifford, 2002).

3.2 Color Scheme

3.2.1 Colors

There are no universally valid rules for the use of colors. Too often, we are taken in by overly fashionable color choices. For this reason, it is also risky to let children choose the colors. It is also very difficult to reach agreement because personal tastes are so different. Color perception is a matter of very subjective sentiments.

Regarding the choice of colors for school spaces, Frieling and Sonntag (1999) recommend consideration of the basic age-specific color preferences. Studies have revealed statistically significant changes in the preferences for colors that correlate with age. A sequence according to the order of rainbow colors, respectively the sequence of Goethe's color wheel, appears to be appropriate (cf. Peter Busmann, 2005).

Furthermore, care should be taken to use colors in such a way as to facilitate vision. For example, strong contrasts between the blackboard and background wall can lead to fatigue (Frieling & Sonntag, 1999).

To accommodate all children with respect to color choice is a difficult task for all those involved in the design of school spaces. It requires careful discussion, and even trial schemes may have to be considered, since the first solution is not always necessarily the best. While one child may experience pleasant feelings with a particular color combination, it may make another student feel cramped or intimidated (Rittelmeyer, 1994). The fact that many children have various forms of color blindness calls for special considerations that we cannot get into here; the assistance of trained color experts may be appropriate. Color should serve as a part of the architecture and work with it. We all harbor the desire for color harmony in our environment, and many studies show that such environments can increase well-being and performance.

Choice of colors for a room is not just a matter of "interior decoration," but the creation of a pleasant atmosphere and mood. Spaces perceived as unpleasant and ugly with respect to their color design will have a negative effect on the motivation and desire to learn and perform as well as on well-being. But spaces that feel pleasant, radiating warmth and softness, where colors and forms are well coordinated, will have a strong positive effect. Colors in schools should be friendly and inviting, not uncomfortable or even intimidating. Our forebears had an easier time with this: They only had natural, mostly milder and lighter earth-colors, which harmonized better and were therefore easier to combine (cf. Mahlke & Schwarte, 1989, p. 93, and 1997). So where should we look for guidance in choosing colors for schools? No specific guidelines can be derived either from the tradition of church color symbolism or Goethe's color theory. In spite of the considerable work and experimentation that has been devoted to this topic, the issue of color in schools will remain a topic of discussion in future as well. At this time, we can maintain that light and colorful spaces have a more positive effect on children than dull and dreary ones, that light spaces appear larger than dark ones and keep feelings of crowdedness from arising, and that blue colors are better than reds because blue is a calming color (cf. Bell, Greene, Fisher, & Baum 1996; cf. Gifford 2002, p. 30).

3.2.2 Color Perception

The human retina lets us perceive miniscule differences in lightness as well as colors. It has two kinds of receptors cells: rods and cones. The rods receive only differences in brightness; the cones let us perceive colors. When light of a certain wavelength falls on the retina, it incites impulses in the cones that lead to a color sensation (Zwimpfer, 1985, p. 247). There are three kinds of cones, which differ in the color of light to which they respond: blue, green or red, the three basic additive types of light. The laws of additive respectively subtractive color generation are based on the way the eye reacts to light rays of different wavelengths (ibid., p. 256). More light is needed to distinguish colors, which is why colors are hard to recognize at lower lighting levels, and why colors are judged differently in daylight and in artificial light. The retina adapts to the lighting conditions. "Colors are only recognized as colors when they occur in sufficiently strong lighting levels, and are clearly distinguished as different from their surroundings" (Steiner, 2000, p. 33).

Steiner's Color Theory

Rudolf Steiner (1861–1925), anthroposophist and founder of the Waldorf schools, also did remarkable pioneering work in the field of color design. In the early 20th century, he developed important ideas for design with color. Claiming that the color of the space surrounding a human being is by no means unimportant, he went even further and stated that a person's temperament influences how we react to various colors.

It should also be considered how long a person is exposed to a certain color, and whether it occurs repeatedly or just very briefly. Because colors have different effects, the kind of activity that will occur in a space must be taken into account before deciding on a color (cf. Raab, 1982, pp. 208 et sqq.). Steiner said that colors of spaces and objects do have real connections to a person's moods and feelings.

Steiner makes distinctions between normal classrooms and other spaces intended for special subjects, for encounter or for movement. Because children use classrooms for the entire year, the room's color will dominate their mood for a long time, and it is important to have the colors in other spaces extend this basic mood through different colors. Steiner's approach consists of having students experience a sequence of colors during their stay in school. For example, in the Waldorf school in Cologne, the classrooms for grades one through three on the first floor are held in warm red hues. Beginning in first grade with a darker red, the color changes towards orange in third grade. On the second floor, we find the fourth grade classroom with a delicate orange which, however, already tends towards yellow. "Warm hues continue with the yellow of fifth grade into the green of sixth grade" (Dürr in the Festschrift Freie Waldorfschule Köln, 1998, p. 57). In subsequent classes, the green cools down and turns into blue in eighth grade. As indicated, the warm colors predominate, in gradual transitions, up to seventh grade, and cool down only in eighth grade. On the third floor, where the upper grades are located, the color scheme is expanded by the addition of various materials. Wooden beams and exposed concrete, materials with different colors and textures create entirely different impressions.

Steiner also coined the concept of the "transparent" respectively "opaque" wall. Using translucent or semitransparent paint techniques, the final color only appears on the wall after covering it with several coats of paint. "Looking at the different coats of transparent paint, one can follow the transformation of colors. However, this is not obvious at the first quick glance. The colors have to be explored; seeing the transitions requires time and an open eye. One's standpoint, changes in the line of sight as well as lighting conditions create finely nuanced differences in the perceived hues" (ibid., p. 59). To achieve this, it is recommended to use mineral or plant-based pigments. The wash-like coats of paint create a sensation of transparency. Using color and light, one can then emphasize the unity of a space.

The hues in this building are often ones that were hardly ever found in earlier buildings: light red, pink-violet, violet / light blue-violet, red-violet, violet / mallow-colored.

Steiner expands the color selections previously used in buildings beyond blue and violet into peach blossom colors. For him, violet hues contain both activity stemming from the red and concentration associated with the blue. Combining the two creates a new color experience. He uses a reddish-violet for an exercise room, believing that this color is appropriate for activities involving abandon. For spaces devoted to activities with calm postures, involving mental skills and concentration but also fine manual work, he applies a light violet. Workshop spaces call for an active color without blue components; here, he recommends orange. He uses different shades of lightness to accentuate different areas within the classroom.

All these examples demonstrate the importance Steiner attributed to color choice for the purpose of creating a pleasant work atmosphere (Raab 1982, pp. 205 et sqq.; Dürr in Festschrift Freie Waldorfschule Köln, 1998, pp. 56–61).

3.3 Form Design

Instructive studies regarding the topic of “Form and Color Design in School Construction” were carried out under Christian Rittelmeyer’s leadership at Göttingen University. In the search for a sympathetic school design it is important to understand the wishes of students in respect to color and form. Rittelmeyer’s aim is to find out which features of schools make them look inviting, pleasant and beautiful, and what characteristics evoke negative reactions towards the building.

In one study, 200 students were asked to assess schoolhouse facades and interior spaces. Their responses were to be entered in a series of polar scales with 25 steps. The characteristics of the facades to be evaluated included “oppressive-liberating,” “chaotic-ordered,” “soft-hard,” “friendly-unfriendly.” Such studies indicate that certain spatial forms and colors are often unanimously regarded as positive by students, whereas other constellations are overwhelmingly rejected.

These studies identified three features, which Rittelmeyer calls “sympathetic features” for school design. A school would be considered friendly/pleasant/inviting and beautiful if it could be perceived, in form and color design as

- varied and stimulating;
- unconstrained and liberating;
- warm and soft (Rittelmeyer, 1994, p. 47).

Noack (1996) points to a connection between architectural form and perception, with special reference to visual perception and the sense of equilibrium. “Even the perception of a motionless object has an effect on muscle tension. Eye movements which generate impulses (to the brain) follow the geometric forms of the architecture and thus become the basis of the person’s mood at the moment (Rittelmeyer, 1988, p. 386, quoted after Noack, 1996, p. 89).

According to Noack, our vision needs fixed orientation points as well as the challenge of the imperfect. But exaggeration harbors the danger of chaos (ibid., p. 89). With respect to school design, this means that monotonous and uniform school buildings can make users feel ill at ease just as much as overly complex and detailed, agitated forms. Noack favors simple geometric forms whose symmetry has been slightly disturbed.

In other words, children want varied but not chaotic schools with unconstrained building forms, including nonoppressive ceilings and appealing color schemes. The buildings should exude warmth and softness, and forms and colors should be integrated in harmony.

However, the three “sympathetic” school features identified by Rittelmeyer apply only to the students’ point of view. It should also be considered that such studies might be influenced by predominant trends. In addition, different projects can yield different results. This means that the three criteria cannot be clearly distinguished: An unconstrained building form can be perceived as varied, perceived warmth could reduce the effect of an open form (Rittelmeyer 1994, pp. 43–50). Certainly such research results can also be influenced by fashionable preconceptions of the evaluators; it would be important to repeat such investigations at different times and in different locations.

3.4 Lighting in Schools

“The lighting conditions of a room are of utmost importance for its atmosphere and for the mood and well-being of the people occupying it” (Walden & Schmitz, 1999, p.88).

Schools should be designed in such a way that from the earliest planning stages onward, lighting technology will be included in the effort to enhance learning ability, well-being, and health of all users (Pracht ,1994, p. 164).

“Lighting and the guidance of light are of central importance for the perception of space and objects in space” (Mahlke & Schwarte, 1997, p. 90).

In considering light, it is necessary to first of all distinguish between natural and artificial light, and the different qualities of light. Nature offers a very diverse variation of lighting conditions ranging from blinding daylight to moonlight at night. Fire is considered a natural light. Natural daylight has a positive impact on bodily and mental well-being of all humans. This is why school design should utilize sufficient daylight – which, after all, is “a very cheap building material” (Busmann, personal communication, August 12, 1999). This is where many serious mistakes were made in German school design during the 1970s. It was thought that windowless schools would protect children from disturbances from the exterior, and thus counteract concentration problems.

But some studies soon demonstrated that this assumption was wrong. Most of the comparative studies concerning the effect of light on performance, well-being, and social behavior stress the importance of light that enters a room directly through windows, or is generated by special daylighting fixtures (Maron, Ott, Nations, & Mayron 1974; Fletcher, 1983; cf. Gifford, 2002). Performance improves in the presence of daylight, and its positive effect is manifested in better social behavior. Light that is too bright, such as is often found in classrooms or offices, has a negative impact on well-being. According to a study by Knez (1995), cold light influences the mood of women negatively, while it improves that of men. In a society where men and women share most spaces, it is therefore obvious that cold or warm light will benefit only one or the other. Therefore a lighting level must be found that is as appropriate for both as possible. In schools, one solution might consist of classrooms with windows and additional artificial daylighting with adjustable brightness.

Compared with white fluorescent light, lighting by means of daylight or daylight fixtures resulted in better attention, better reading performance, and better processing of basic information (Mayron, Ott, Nations, & Mayron, 1974; cf. Kueller & Lindsten, 1992; Collins, 1965, regarding windowless classrooms.) Collins reported that after one year of using a windowless classroom, students' opinions were against it. With natural daylight, results of reading and math tests were up to 26% better. But Hedge (2000) reported that students who expressed a preference for dim lighting indeed worked better under such conditions.

Since the invention of artificial lighting in the 19th century, we appreciate being able to use it in our homes and, of course, in schools as well, especially during the dark winter months and in the transition hours between day and night. But it has been demonstrated that especially artificial light has very different qualities that affect human well-being and performance. The warmth of light is significant in this respect. "Light that is too cold will be perceived as unfriendly, technical, uncomfortable (Frieling & Sonntag, 1999, p. 88). It was also shown that artificial lighting exposes the human body to stronger irritating stimulation (Küller, 1996; cf. Walden & Schmitz, 1999, p. 88). Poor lighting design can lead to increased fatigue and even headaches and damaged eyesight (cf. Frieling & Sonntag, 1999, p. 344). For these reasons, there should be more research on what would be the best arrangement of lighting in classrooms.

We know that general, centrally located or evenly distributed lighting fixtures on the ceiling will not be adequate. "Fluorescent lighting robs objects of their shadows. People too become shadowless in this kind of even illumination, which is touted as the special advantage of this light, but they lose their plasticity and the beauty that derives from it (Mahlke & Schwarte, 1989, p. 90; 1997).

In schoolrooms, differentiated and variable lighting systems should be used that support the instruction offered at any given time (Engel & Dahlmann, 2001).

To accommodate the multiple visual tasks in schools, whether in working with tools, in loose seating arrangements in open instruction forms, or when retrieving learning resources from shelves or computer stations, the DIN norms prescribe a general illumination and an additional, separately controlled source of illumination to increase the vertical illumination strength in the area of the blackboard and of demonstration counters in specialty rooms. The characteristics and arrangement of lights must be adapted to the specific form of instruction and corresponding seating patterns (Wasserfurth, 1996).

“Through appropriate design and construction of windows as well as lighting fixtures, the lighting design should ensure that the natural variations of daylight intensity remain perceivable, that the changing position of the sun throughout the day can be followed even inside, and that artificial light imitate the spectrum of sunlight. It is important to aim for a spatially moving, changing gradient of light to dark (Dederich, 1996, p. 231).

Kükelhaus claims (according to Dederich, 1996) that there is a gender difference in how light influences human well-being. Therefore, efforts should be made to find a lighting solution for schools that optimally meets everybody’s needs in increasing well-being and performance. In classrooms – which, according to the DIN standards, now must have windows – there should be additional lamps with dimmers to regulate light intensity of selected zones instead of flooding the classroom with the same lighting level. Lighting conditions of classrooms should be adjusted for different functional zones within them, so as to ensure best learning and work conditions for different activities (Mahlke & Schwarte, 1997). Special attention should be given to the avoidance of glare, which can lead to diminished vision, indisposition, and headaches resulting from overexerting the eyes. Sufficient additional electrical outlets should be provided to allow adding more light fixtures as needed. For children’s spaces, artificial light should not be placed on the ceiling, that is, far away from the children, but close to play, work, and eating areas, and if possible, so that the children themselves can turn it off and on (Mahlke, 1985, p. 185).

Not only the placement but also the construction of the light fixtures deserves attention. Lighting fixtures for classrooms should be rugged and designed for simple operation and maintenance. Consideration of first cost versus annual operating cost will guide selection as much as the fact that classrooms will serve many different people, both children and adults, with different needs.

There are many possible lighting design schemes that might be considered in school construction. It is necessary to consider this question in the very earliest stages of over-all concept development. It is meaningful to employ a professional lighting expert who can deal with problems emerging during the planning process. It would be wrong to try to save costs at this stage; after all, about 20% of the population is affected by these decisions.

3.5 Heating, Cooling, and Ventilation

The well-being of those learning and teaching in schools depends not only on the color scheme and lighting, but also on climatic conditions, specifically on the microclimate in the space itself, which must be distinguished from the macroclimate, the overall weather conditions in the town or region.

We can only influence the microclimate. But in the classrooms, we can try to achieve the best possible temperature for all concerned. This is important not only during the winter months when living and working spaces must be heated to achieve an acceptable temperature, but also in many regions in the summer when the weather requires cooling of interior spaces.

Modern air-conditioning systems make it possible to achieve both, but their high costs of installation and operation are still obstacles in many places. Constant temperature and humidity, clearly defined volume of cleansed, fresh air as well as avoidance of drafts guarantee that biological adaptation mechanisms (adapting body temperature to outside conditions) do not have to be excessively activated. In this way a climatic working environment can be created that is largely independent of the macroclimate and closely adapted to user needs (Frieling & Sonntag, 1999).

Environmental psychology has investigated the relationships between climatic conditions and human comfort perception and developed criteria for the determination of "comfort zones" in which people feel subjectively comfortable with the climate conditions of a space (Veitch & Arkkelin, 1995). The Kansas Study (Rohles, 1975) demonstrates that there is a connection between humidity and the temperatures that are felt to be comfortable. Tests studying these criteria led to the finding that most people perceive the comfort of temperature in relation to humidity. Efforts such as the KSU-ASHRAE Comfort Envelope (Rohles, 1973) attempted to define the boundaries of these comfort zones by varying temperature and humidity separately and asking test persons to indicate their level of comfort or discomfort for different combinations. However, these tests also made it clear that the results depend to a considerable degree on personal factors such as clothing, extent of movement, age, and other bodily and psychological conditions, as well as gender.

However, while some studies indicate that the best temperature for learning is about 21 degrees Celsius/70 degrees Fahrenheit, maintaining of an unchanging space temperature has been shown to be unfavorable. It is adverse to our organism and results in fatigue. Besides, temperature sensation is also subjective. Furthermore, questions arise whether more ecological alternatives would be applicable. In future, means for passive heating and cooling, which depend more on the overall design constellation, will have to be increasingly taken into account. “Cooperation between architects, engineers, and ecologically oriented planners will be needed to achieve heating energy savings by means of energy-conscious design concepts” (Eissler & Hoffmann, 1988, p. 19). Problems caused by sun shining into classrooms can be mitigated by means of adjustable blinds that provide protection from strong sun rays but don’t reduce light

Serious mistakes have often been made with respect to ventilation in schools. Inadequate ventilation can reduce student performance and cause drowsiness (Sanoff, 2002). Efforts should be made to find solutions (and ways to finance them), that will guarantee good ventilation at all times. Many of us have noticed during our own school days how at the end of the hour we seemed to get more tired, which in part was due to lack of oxygen. Prevention is needed here. Traditionally this was done by means of cross-ventilation; today the preferred method is artificially controlled ventilation. A permanent ventilation system that provides both air supply and exhaust would always be desirable, but unfortunately not always feasible because of cost.

One positive example is the sophisticated ventilation system in the Cologne Waldorf school. It enables the school to save energy at the same time as offering a high quality of air in all classrooms. Subterranean air ducts supply the school with air that is kept at an appropriate temperature for the season, without the use of mechanical technology. In addition, sod roofing on the gymnasium and parts of the main building provide good insulation as well as a natural integration into the landscape.

3.6 Acoustics and Noise

Sound intensity is measured in decibels (dB) on a logarithmic scale that indicates the sound pressure of a given sound relative to the sound pressure at the absolute thresh-old of hearing (Zimbardo & Gerrig, 2004). The louder the sound, the higher the decibel value. When sounds occur in a loud, unpredictable, and uncontrollable fashion, we call it noise. Noise, in contrast to sound, cannot be measured. Just as density relates to crowding, sound relates to noise. In the literature, “loud sounds” and “,noise” are used interchangeably with the same meaning.

Noise is considered one of the great problems of our times. In Germany, around 40% of the population consider themselves bothered by noise permanently or temporarily, which justifies its characterization as an epidemic (Federal Government Report on the Protection from Pollution, 1982, according to Flade 1987, p. 134). It must be stressed that noise perception is subjective. Street traffic is considered the main source of noise, followed by rail and air traffic and then by noise from industry (Guski, 1977, according to Flade, 1987, p. 135; cf. Flade, 2006).

In spite of the fact that good acoustics are recognized to have a strong influence on successful learning in schools, the effects of noise are not taken sufficiently seriously (Klatte, Meis, Nocke, & Schick 2003; cf. Huber, Kahlert, & Klatte, 2002). Acoustic deficiencies occur when classrooms have strong reverberation, speech is hard to understand, or background noise levels are too high.

Speaking and hearing are still the main activities involved in teaching and learning, though there is a rising influence of internet- and multimedia based learning forms. But in many schools, acoustic conditions are so bad that verbal communication is only possible by screaming. Sports instructors often have to endure noise levels of 90–100 decibels. Average noise levels in German elementary schools throughout a class period have been measured as 70–77 decibels. By comparison, the German norms for noise levels for workplaces involving mental activities prescribe a noise level of no more than 55 decibels, and where verbal communication is the goal, at most 40 decibels. The sound level of speech should be about 10–15 decibels above the background noise level. Noise is a basic stress factor. Teachers are suffering from noise while working. The flow of advice is interrupted by frequent repetition of information and exhortations to be more quiet. Aggravation, irritability, fatigue as well as throat and voice problems are the consequences. Poor hearing conditions cause misinterpretation of information or even complete misunderstanding. This leads to a reduced capacity for short term memory and mental processing of information. A rising number of children suffers from hearing problems.

These conclusions regarding noise do not call for absolute quiet and discipline in the classroom, however. Sounds can be beneficial when they consist of natural sounds such as birdsong or weather (light winds or rain). Pleasant activities such as independent work, singing, or festivities make the sound levels rise. A certain amount of noise can have beneficial effects upon the human body, and especially activates our sense of equilibrium. The ear is an organ that not only serves hearing but also orientation and equilibrium in space: an organ of orientation for body, soul and spirit. Accordingly, it would be a mistake to completely insulate spaces with acoustically absorbent panels but rather to allow for some echo and reverberation (Dederich, 1996, p. 231). Therefore it is important to design the classrooms in such a way as to prevent negative effects and promote positive educational development. This can be achieved by simple means such as replacement of felt pads under chairs and tables, checking furniture for squeaking drawers or clattering desk covers, lubricating squeaky door hinges, hanging heavy curtains, and using cork panels or wall tapestries.

The acoustics of a space are often not given sufficient attention in school construction. One step to ensure good acoustics is that of achieving a good distribution of sound levels. This can be influenced by means of appropriate placement of reflecting and sound-absorbing surfaces, so as to reduce reverberation. Besides the overall noise level, reverberation is the key variable of acoustics. It refers to the total time span from the generation of a sound until its reduction to where it cannot be heard anymore. For classrooms, a reverberation time of 0.8 seconds or preferably less is desirable. Technology nowadays allows engineers to calculate and simulate reverberation times already during the design phase (Vorländer, 2002).

According to Rebhuhn (1996), several kinds of acoustically effective absorbing materials are available:

“• porous absorbing materials such as fiber materials or open-cell foam insulating materials;
• resonance absorbers, that is, plywood or gypsum board shell panels with closed of perforated surface.”

The degree of absorption depends to a large extent on the particular frequencies of sounds. Therefore a combination of both types of absorbing materials is useful in most practical situations. But already such items as wooden pedestals can help to break the sound levels in a space and reduce noise levels. Carpet flooring also helps noise reduction, but their hygienic aspects must be considered (Mommertz, 2002). Curtains can achieve improvements of acoustic conditions if the material has the required properties. But each of these by themselves will not be sufficient.

As we can see, it is possible to take meaningful steps towards control of acoustic conditions in planning a building. However, control traffic and industrial noise must be considered earlier, in selecting the site.

Studies have shown that significantly increased blood pressure could be observed in users of school buildings situated near roads with heavy traffic. In elementary schools exposed to traffic noise, children suffered from concentration problems (Lackney, 2000). This was reflected in a higher rate of mistakes when dealing with difficult tasks, and a higher rate of incidents of giving up tasks before time was up. Gifford (2002) concluded that the performance of girls is impaired by traffic noise to a higher degree than that of boys, and that autistic children are affected more seriously than hyperactive children.

However, a certain amount of noise can have beneficial effects upon the human body, and especially activates our sense of equilibrium. The ear is an organ that not only serves hearing but also orientation and equilibrium in space: an organ of orientation for body, soul and spirit. Accordingly, it would be a mistake to completely insulate spaces with acoustically absorbent panels but rather to allow for some echo and reverberation (Dederich, 1996, p. 231).

Studies in the area of noise annoyances in schools are of rather more recent dates (Schick, 1997). Whereas it was simply and sweepingly referred to as "noise problem" until about 1970, seen as a deplorable and aggravating but unavoidable accompaniment of school life and instruction, the following decades saw much more thorough studies of this phenomenon. One detailed report should be mentioned, by August Schick, Maria Klatte and Marcus Meis, entitled "Noise annoyance in students and teachers – a report on the current state of research" (1999). Its list of 200 references shows 118 contributions dating from 1990–1999, 60 items for the decade of 1980–1989, and 11 publications for the period 1970–1979. The oldest titles are from 1968 and 1957.

Increasingly, the attention of educators is focused upon the issues of noise, climate in schools, better awareness of self-generated noise, workplace related health questions, learning program s for hearing protection, a "Healthy Schools Network," a media package "All Ears" in Switzerland, as well as many books, articles and programs about "Education for Quiet." Attention to these questions is more and more perceived as mandatory.

Indicators for the increased degree of differentiation with which these problems are treated are the concepts of acoustics, reverberation time, background noise, working memory, psycho-neural attention, individual reaction patterns, noise immission intensity, interference with learning processes, patterns of coping with stress and anxiety, and preventative environmental medicine.

Audial functions support speech communication. In the instructional process, speech carries central importance and it requires clear comprehension. In all processes, whether affective, cognitive, psychomotoric, whether action or project related, whether in practicing social relationships or method learning, communication is a key factor. In this, comprehensibility depends on the acoustic conditions of the room. At a distance of 60 cm (2 feet), the participants in a conversation will already receive speech in reverberated form. All the reflecting surfaces of a room, the number of people in it and the furniture, support or reduce comprehensibility. Children with any kind of hearing problems will be immediately put at a lasting disadvantage. Especially excessive reverberation can multiply speech distortions and the level of disturbing background noise.

Practical guidelines related to acoustics have been included in the list of guidelines and useful suggestions for new school building as well as renovation projects. Findings regarding noise problems are being taken seriously and increase the care of architectural work. The institutions responsible for school construction as well as authorities have reacted and included such considerations in their regulations. The central common concern is the well-being and learning conditions for the students.

3.7 Furniture and Equipment

In today's schools, students are no longer expected to sit still in rows of seats to listen and respond to the teacher. Instead, we expect responsive schools (Sanoff, 2001) in which students and teachers are engaged in different learning activities inside and outside the classroom (Walden, 2002; Wenninger, 2002, p. 11).

Modern instruction requires varied and diversified forms of knowledge transmittal. Active learning methods are becoming more prevalent. These include the project method, independent learning, simulation methods such as case studies, role-playing and planning games. For a future-oriented education, scenario methods and future workshops are gaining acceptance (Kaiser & Kaminski, 1999). Such innovative, open instruction forms require spatial conditions and furnishing patterns.

3.7.1 Media Tools and Instructional Aids

Neither modern media tools nor adequate instructional aids should be missing in any school today, as the basis for diversified instructional design. It should go without saying that both of these should be constantly monitored for state of the art adequacy and work-ability. Gifford (2002) reports that teaching aid shortages can lead to conflicts and even aggressive behavior in younger students. With older students, out-of-date instructional materials can generate antipathy and reduced motivation to learn.

Buddensiek (2001) points out that productive independent individual work, or work in partnerships and teams depends on adequate availability of materials such as books, games and the like. These should be available in close proximity in shelves and cabinets. He further argues that "learning spaces that do not have an adequate number of computer workplaces can no longer be considered ready for the future" (ibid., p. 188).

3.7.2 Furniture

"The classroom chairs are our children's tools for the school's working day" (Berquet, 1988, p. 17). Therefore these tools should be adapted to their users as much as possible. If this is neglected, negative consequences can occur that include not only well-being and performance but also posture problems.

During their growth periods, children seek movement that is necessary for muscle development. This is not helped by having them sit still for hours in school. In combination with inadequate furniture, this results in as many as 50% of children suffering from posture problems (Berquet, 1988, p. 17).

The rigid benches of earlier schools have, of course, long been abandoned in favor of chairs and tables, which helps to avoid premature fatigue. Sitting allows the muscles to relax. But furniture that strains the muscles robs the body of energy that is, in school, needed for mental activity. Usually, schoolrooms are furnished with standard chairs and tables. Studies by Bullock and Foster-Harrison (1997; cf. Butin, 2000) show that persons working on unpadded chairs are unable to sit still and concentrate for more than 50 minutes. But chairs in classrooms are usually neither upholstered nor adjustable. Are children's sizes and scale even considered? The norm is to merely establish average measurements for body size, height of eye level, shoulder height and width, hip width, knee height etc. in relation to age. Children of early or late development are left at a disadvantage. Cost considerations are an argument against individual adjustable furniture, but this is desperately needed, and often the costs are not all that prohibitive. Expert guidance can help. Both chairs and tables should in future be individually adjustable to each students' measurements, checked at least every six months. Teachers must check whether students are sitting properly. It might be helpful if teachers and parents had a say in decisions about furniture purchases for classrooms.

Besides the ergonomic adjustment of school furniture, flexibility and functional issues must be considered. Furniture and equipment should accommodate the arrangement of group work zones and discussion circles, not encumber these (Buddensiek, 2001, p. 196). Moreover, classrooms should facilitate quick and easy changes between very different instructional forms. In detailed investigations towards future-oriented learning space design, he concludes that rectangular tables are still suitable for the traditional frontal lecture format as well as individual work. But for innovative, more active learning styles that require cooperation and communication, they rather constitute obstacles.

In the classrooms, all students should be able to store their materials – that are not immediately needed for ongoing work – in easily recognizable compartments. This calls for shelves and cabinets designed to children's scale. If such cabinets are equipped with wheels, they can be used as convenient space dividers, for example to create separate reading or relaxation areas, without great effort by the students themselves. Such areas can be embellished by adding a carpet, a couch, a table and plants. It would be the task of students, teachers and even parents to create such 'homelike' places within the classroom. Adapting from the home environment to the institutional environment such as the school can be stressful especially for the younger children. Studies show that familiar environments similar to that of the home can help reduce student anxieties while also increasing well-being and the ability to concentrate (Lackney, 2000). At best, a separate room or space would be situated next to the classroom, and be available for student use even during breaks and free hours. Students should be given considerable responsibility for the design and decoration of the classrooms. This will lead to the children forming close relationships to their room, which in turn is the best way to prevent vandalism.

In addition, the decoration of classrooms but also of hallways, staircases and outside spaces will increase children's well-being in school. In turn, a friendly school environment has positive effects on student performance.

3.8 Density and Crowding

Feelings of being crowded and encumbered can arise when we have to share a small room with many people. "High density is correlated with negative emotions, physiological overexcitement and even increases in various illnesses as well as changes in social relations – such as reduced readiness to help others and increased aggression (Bell et al., 1996, according to Schuemer, 1998, p. 57). Density is an objective measure of spatial constraint. Density – for example, as defined by number of persons per unit of space (persons/sq. ft. or its inverse, sq. ft./person) or occupants per classroom – must be distinguished from the subjective feeling of crowding. Both these concepts are important topics in architectural psychology. Using findings by Smith and Connolly (1980), Gifford (1997, p. 267, and 2002, p. 322) concludes that a medium desirable density in classrooms for preschoolers would be about 2.8–3.7 square meters (30–40 square feet) for each student. Higher or lower densities have a negative effect upon the student. Gifford also mentions other studies on the relationship between density and performance, which found that lower densities improve student performance and increase the time children are able to concentrate on tasks (Thomas, 1987). Also, the difficulty of work influences performance together with density. For example, in open instruction methods where children move around in the classroom, solving difficult problems becomes harder with increased density (Heller, Groff, & Solomon, 1977).

3.8.1 Privacy

Privacy is commonly understood as "being alone and protected from being seen by others" (Flade, 1998, p. 58). Altman (1975) defines privacy as the "process of control of the access of others to oneself or one's group." Reading these definitions may raise the question of how they relate to schools where teachers and children work together in one room entirely without privacy (as understood by these definitions). The youngest elementary school children do not have a strong need for privacy yet, or only to a small degree. But with increasing age and development the need for privacy changes and becomes pronounced in older students. "Environments for groups should be designed in such a way as to permit control of privacy on the individual level as well as for the group" (ibid., p. 58). This means that school design cannot ignore the need for privacy. But in schools, privacy currently really exists only for the group in a classroom with respect to all those outside. It is important to provide areas in the break rooms, in outside areas, but also within each classroom, where smaller groups or even individuals can retreat into relative privacy. Why is it necessary to worry about privacy in schools; after all this is an institution where we live and work in common? Every person uses privacy differently. One student needs it to convey information about himself to others, the other for the purpose of distancing herself from others, to be alone and undisturbed.

It is therefore reasonable to ask that students be given the opportunity for retreat during the breaks, just as much as teachers or principals who can retreat into their teachers' room or office to be by themselves for a while. But what might this look like in reality? Of course it is not feasible to provide a separate room for every student. But it might be possible, by means of quiet-work rooms or relaxation rooms, to achieve the opportunity for retreating into a zone of no direct supervision and a small degree of privacy. Each classroom should also be designed in such a way as to offer a retreat area that might be protected from views by others by means of curtains or blinds. Such areas must be equally accessible by all students.

Studies by Sundstrom and Sundstrom (1986) suggest that the degree of privacy does not influence performance; it is only related to the sense of satisfaction with the environment. Even so, we believe that every user of a public building, every student, every teacher should have the opportunity for such a retreat into a zone of relative privacy. Every user is different; some will eagerly take advantage of such opportunities, others might not. But if there is no opportunity for retreat, this will certainly affect human well-being. In addition, there are many issues teachers must discuss with students in private and not in the presence of the class. It is not appropriate to have to use half-public areas such as hallways for this: private areas will be needed especially for such purposes.

3.8.2 Conflicts and Aggressive Behavior

Conflicts arise not only at the level of social and interpersonal relationships, but they can be caused directly by spatial conditions. Children and young people are not well equipped to work out such conflicts by themselves, and this often results in aggressive behavior. Aggression is understood as behavior aimed at deliberate hurting or damaging (cf. Nolting, 1997, pp. 21 ff.). It can manifest itself in bodily actions, in speech, or facial expression or gestures. But the many forms belong to the same heading and ultimately have the same goal of inflicting hurt or damage. Aggression is often a means towards achieving an end. Distinctions are made between expressive aggression, venting of emotions, and instrumental aggression aimed at achieving a goal quickly. It is a primitive means to satisfy needs and desires. Such behavior is influenced by family, supervising adults in game and sports activities, and peers, but also by the school and the spatial conditions in the school building. Smith and Connolly (1980) found that aggressive behavior increases with density (that is, with more people per unit of space), when material resources do not match the increased group size. But not just density is important, but also the quality of the environment. We have not found any studies showing that aggressive behavior can arise when privacy is lacking, but we feel that this is the case. If people have the opportunity for retreat, perhaps aggressive behavior will not have the chance to occur in the first place.

Aggression is a sensitive topic especially in schools. Good spatial conditions and teacher-student relationships can help to contain aggression. It is important that the school is seen as a place for positive encounter and not as a stage for conflict.

3.8.3 Schools as Places for Encounter

Schools are places of daily encounter. For many children, especially for those from troubled family situations, the school is a place of continuity. Schools should be places offering supportive and stimulating conditions for the life in them. Especially the spatial conditions can contribute to students experiencing social togetherness and community. This means that inside and outside, they must offer places for encounter where young and old can meet, share experiences in an atmosphere of peaceful conviviality free of violence. This is best achieved when those places have been created together. "Safety, openness, and challenge are the basic conditions for elementary schools becoming nurturing living and learning places for children" (Faust-Siehl et al., 1996, p. 32). Younger children, especially in the first few grades, have entirely new experiences in class. Because of the trend to have fewer children, frequently troubled family conditions, and predominant indoor living, some children experience a large group of children of their own age for the first time. New rules for community are developed and tested. Children of the same age, older students, and teachers are an integral part of this testing ground.

The conditions and effects of density and crowding on performance, well-being and social interaction were mentioned earlier. Density and crowding are always dependent on the given room size. But according to Lackney (2000) the class size and the total school population that result from these aspects will affect the user of learning environments. To achieve the best instructional results, Lackney recommends the following guidelines for class size: 12–16 children in elementary schools, 16–20 in the middle levels, and beyond that, no more than 20–24 students per class or "learning unit."

Glass, Cahen, Smith, and Filby (1982) believe that once a class has reached a size of 20–25 students, additional students only make a negligible difference (cf. Schnabel, 2001, p. 482). They conclude that smaller class sizes will result in better learning environments on just about every aspect, including students and teacher attitudes, interaction and performance.

Regarding the overall size of schools, Lackney (2000) calls for placing caps on the number of students in the typical American school. There is a growing demand for smaller schools. Cotton (1996) noticed that students in smaller schools held a more positive attitude towards their schools as well as special subjects than students in larger schools. Where it is not possible to reduce the total number of students, Lackney recommends other decentralizing steps of both architectural and administrative nature. Studies concerning school size and student numbers indicate that students in "smaller" schools (of 100–150 students) tend to exhibit more active participation in extracurricular activities and development of leadership roles (Barker & Gump, 1964). Lackney (2000) reports that participation in such activities and organizations as well as satisfaction with school is higher than in larger schools (i.e., schools with more than 2000 students) and that schools with fewer than 500 students show a lower rate of criminal and other deviate behavior.

Walden (2007) summarizes the advantages of smaller schools, which, according to a survey by Wasley, Fine, Gladden, Holland, King, Mosak, and Powell (2000; cf. also Raywid, 1999) outweigh those of larger schools. In a synopsis of empirical studies, these authors found arguments in favor of small schools and intimate learning groups. In these groups, the teachers know their students well, are able to encourage student to do better, and the adults can do a better job of watching children in their care. They help to avoid isolation which manifests itself in alienation, vandalism, theft and violence (cf. Linneweber, Mummendey, Bornewasser, & Löschper, 1984). Smaller schools help minority or economically disadvantaged children to progress more quickly, and teachers can be encouraged to put their own experience to work for the benefit of students (Wasley et al., 2000, p. 2). In addition, it is easier to coordinate teaching activities (Fowler & Walberg, 1991).

Just as much as the class size, the seating position of students within the classroom can influence performance, well-being, and social behavior. Several studies agree that seats in the middle of the classroom, facing the front, seem to be associated with better performance and participation (Becker, Sommer, Bee, & Oxley, 1973; Sommer, 1972; cf. Bell, Greene, Fisher, & Baum, 2001, p. 263 et sqq.). According to McAndrew (1993), the back of the room is associated with greater freedom to interact with classmates as well as less intensive teacher supervision. Consequently, there is considerable self-selection of preferred seating by students (Hillman, Brooks, & O'Brien, 1991). A study by Marx, Fuhrer, and Hartig (1999) explored the relationship between seating arrangements and the asking of questions by fourth grade students. It showed that students ask more questions when seated in a semicircle than in row arrangements, and that social interaction is encouraged when students have the opportunity of face-to-face contact. This demonstrates that communication among students is influenced by the seating arrangement. Soft classrooms have semicircular benches with cushions, adjustable lighting, a small rug and a few movable chairs. Such soft classrooms lead to distinctly improved student participation (Sommer & Olsen, 1980).

3.9 Participation and User Design

Identifying with something means to recognize oneself in it. Built environments rarely offer this possibility, because normally the future users have no voice in the design simply since they are not known at the time of planning. Identification depends on participation. In the social sciences, participation is understood as involvement, by individual or groups, in decisions affecting the life of the respective individual or group (Walden & Schmitz, 1999, p. 49 et sqq.). "In this, participation is seen as both a means: toward the end of articulating and ensuring the consideration of concerns, as well as an end in itself, in the sense of self-realization through participation (Deutscher Verein, 1986, according to Schröder, 1996).

With respect to school building, this means that students should have a voice in planning and designing, renovation and furnishing of their schools. Schools should not just be built for the children but with them. As we have seen, the built environment has considerable influence on students' well-being and motivation to learn. Environmental design that is truly based on real user needs can only be achieved through participation (cf. Eichholz, 1992).

This view of the importance of actual participation in the design of buildings may be complemented by a slightly more differentiated view. Hubbard (1980, p. 155) describes a process of engagement by viewers of built environments that might be called "virtual participation" as follows: "Rather, the architect has in mind an ideal of how people ought to live, and he has chosen those particular conventions because he sees a way in which he can use them to express that ideal. He sees a way in which he can have every arrangement of form in his building express some aspect of that ideal. It is in this way in which the architect can guide the experience of the complicitous viewer. No matter which portion of the building the viewer focuses his attention on, he will find a deliberate setup. When he examines that setup for deeper values, he will, by an act of complicity, be able to construct from what is there, reasoning that fits inside of a thought-out and fully realized conception of how we ought to live..." This view assumes that meaningful user engagement with buildings – and therefore also acceptance – is possible even after completion. But it raises the challenge to the architect: a profound understanding of the users' experience (cultural background) is needed for a designer to be able to offer forms users will "recognize" as meaningful building blocks for a vision of how they ought to live.

Through participation in the design and building process, children are allowed to "feel at home"; they are taught by the same process that they can influence their environment. This in turn strengthens their sense of self-worth as well as community. “In addition, children’s skills of communication and cooperation are strengthened, their identification with the space increases their readiness to assume responsibility for their collectively designed room” (Siegmund, 1996). Furthermore, an argument for cost-effectiveness can be made: Participation can prevent planning mistakes and the costs of remedying those. However, participation by children and young people does not mean that they will plan alone; it always means that they will work on problems and develop proposals together with adults. The task of the adults in this consists of interpreting the contributions of the children, together with them, to order them and to help transform them into realizable recommendations that can then be conveyed to the responsible planners. There are architectural firms that have specialized in working with users. The advantage is the automatic occurrence of the “identification effect.” Only people who can identify with a building or space can really quite feel comfortable in it.

“The experience of participation in planning and decision-making about the interior design of spaces strengthens children’s identification with their school, because they experience themselves as active participants and therefore as responsible for the continued care of their school spaces” (Dreier et al., 1999, p. 77).

3.9.1 Acceptance of the School Building: “My (Our) School”

Only identification with the school building makes its acceptance possible. Its users must feel connected to the school, feel at ease in it, and at best consider it a kind of home. Students spend a major part of their youth there, so schools should be “places to be loved, places that generate feelings of home” (Hübner, personal communication, August 25, 1999). This is best achieved if students and teachers are involved in the planning from the beginning, as was the case with the comprehensive school in Gelsenkirchen. Not only architects and engineers have expertise relative to the planning of schools: the future users, teachers and students, also bring in experiences and perspectives that should be brought to bear on the design of learning environments. Combining the expertise of planners and future users promotes the development of a successful design and strengthens the sense of community of a school (cf. Sanoff, 2002). Planning schools without involving future users can lead to increasing alienation, according to Sanoff (ibid.). Whether in a new or existing school, the prime condition for acceptance is that there is adequate opportunity for self-determination, participation, involvement in decision-making and personalization.

3.9.2 Further Development Without the Architect

The future evolution of a school building without the involvement of the architect is important for the identification effect by users. This can begin in the school building itself and end in the outdoor areas. Inside, such projects in which children can take part may involve decorative details for hallways and staircases or the furnishing and decoration of multipurpose rooms. Outside, projects may involve the recess courtyard or playgrounds, planting of green areas, or school gardens or school forests.

Projects planned without involving future users will rarely end up meeting the needs of the different age groups. "User-oriented design is made difficult not only by the needs of the different groups. Complicating the matter is that the interests and values of those groups change over time" (Dieckmann & Schuemer, 1998, p. 38). Therefore, the rooms must be open to future changes. The planning for such remodeling is best done in the form of special project weeks, by project groups, or in common work by teachers, students, and parents.

3.9.3 Organizing a Project Group: Students, Teachers, Parents, Sponsoring Groups

Setting up project groups is a process that builds community. A project group is not a group of classes but an interest-based community. Students sharing an interest gather once a week , either during school hours or after hours to work on their project. Older and younger students are brought together by the project, which may be a new experience for the only child. New acquaintances and friendships are formed. "In such over-arching groups, the potential for aggressive behavior is greatly reduced" (Der Spiegel Nr. 35, 1994, p. 47).

In view of the falling number of school-age children in Germany and the increasingly complex expectations for learning environments, plans for new projects, but also for maintenance or remodeling projects, should include sustainability considerations for future use changes or multiple uses (Kohler & Peter 2004). Such demographic aspects were considered in planning the Brühl-Süd comprehensive school, where architect Professor Busmann designed the classrooms in such a way that they can later be converted to appealing living quarters of a retirement home.

There are many activities and aspects of schools that can become the subject of participatory projects. Examples are: "Our school forest," "the school garden," "we decorate our library," "redesigning the school yard," "beautiful hallways" or "school radio."

Projects allow intensive immersion in a specific subject. The students enjoy considerable freedom to work individually, with a partner, or in small groups. All participants can make their own decisions, strengthening self-sufficiency and independence. Projects, finally, provide a closer relationship to practice.

3.9.4 Preventing Vandalism Inside and Outside the School Building

For the wanton destruction of objects, we use the term "vandalism." It involves "intentional damage or destruction of objects or spaces, and actions that do not appear to the outside observer to have any recognizable benefit for the perpetrator" (Flade, 1987, p. 144; Flade, 1996; Koch, 1986). Such senseless destruction does not occur just anywhere, but, as studies show, predominantly in playgrounds, after-school centers, and means of public transportation – that is, always in public areas.

Rittelmeyer has emphasized for many years that a beautiful facade of a school can reduce vandalism. Another finding was that varied architectural design especially related to color scheme, furnishing and other spatial features that were considered pleasing and comfortable by the children, could counteract vandalism. Klockhaus and Habermann-Morbey (1986, p. 99) report that "In massive and monotonous school buildings, there is more vandalism than in more articulated schools with inventive design and interesting surface treatments".

It is evident that a somewhat "more complex architectural and urban design may be more expensive, but in the long run would pay for itself by reducing the costs for remedying the consequences of vandalism behavior" (cf. van Vliet, 1984; Flade, 1987, p. 146; cf. Flade, 2006).

However, not only appealing design of schools but individual personality characteristics and social conditions must be considered. The size of schools influences vandalism in that in schools with large student populations there is more anonymity and the individual personality finds less recognition. This, together with the fact that there is a lower probability of finding perpetrators, can trigger vandalism (Perings, 1999, p. 104). "One possibility of working against vandalism in large schools might be to organize the school complex into partial 'home areas'. Creating different identifiable zones in the building and school yard provides smaller units with which students can identify more easily and anonymity is reduced" (Asztalos, 1981, p. 4). In many schools there is a shortage of space. This often leads to classes having to switch to different rooms for every lesson, sometimes even within a single meeting. This does not allow students to develop feelings of "being at home." Without the possibility of personalization and identification with a space, vandalism can arise as a reaction (cf. Klockhaus & Habermann-Morbey, 1986, p. 35; Koch, 1986).

Especially in school building, it is important that students have the opportunity to participate in the design, because students will not destroy what they have created themselves! “The more control people have over their daily environment, the lower their motivation to interact with that environment in a destructive fashion” (Flade, 1987, p. 146; Flade, 2006).

If students could be brought to see their classroom as ‘home’, as their living room, and each class community had a special area for which it can assume responsibility and design according to its members’ needs and ideas, vandalism should cease to be as much of a crucial issue in schools.

3.9.5 Development of House Rules

Governmental regulations require that house rules address behavior during emergencies, during recess, and before and after classes, as well as for the entry and exit from the school, and the use of school resources. House rules should not be confused with the overall governmental school ordinances that regulate all aspects of school life. House rules are developed by the principal in cooperation with the school board and parent-teacher association. Students should be heard, but currently have no direct say in this even though they are the most immediately affected by the effects of house rules in their social relations. It would be more meaningful to jointly set up the rules that guide their daily life. We believe that rules would be accepted more readily if students themselves could define their obligations or at least contribute significantly to their formulation. For this reason, internal house rules are sometimes developed for each class, to help students avoid problems in their life together.

In setting up house rules, the first step would be to examine, together with the children, where problems might arise in their daily life. Likewise, aspects relating to the treatment of school property, behavior during recess and in emergencies, and interaction with other students must be discussed and result in accepted guidelines. Because many different personalities coexist in a class community, it is important to develop a set of rules that is fair to all and supports social togetherness rather than stifling it. These rules that order the specific life in class and its organization are negotiated together, and posted visibly in writing, to be observed by all.

3.9.6 User Design

Students and teachers can identify more closely with their learning environment, and therefore increase performance and well-being when given the opportunity for designing their environment. Motivation and readiness to assume responsibility are increased. User design can occur in two different ways: with respect to the design of instruction, and in designing the physical learning environment. In the following, we will focus on the latter. It should be noted, however, that the extent of user involvement in design depends not only on the teachers, parents and students, but also on the conditions posed by the building as designed by the architect. The selection of literature is limited to studies regarding working environments. According to Sundstrom and Sundstrom (1986; cf. Neumann, 1995), user involvement in the design of workplaces lead to higher satisfaction with the environment. Even though these studies only permit conclusions for working environments, we feel that the results are applicable to learning environments as well. A first finding is that involvement in designing one's environment according to one's own ideas gives the user an opportunity for representation of self. This contributes to the user's identification with the environment and with the organization of the workplace.

A second point is that involvement in design can lead to better decisions for the work environment. This results from more diverse and detailed information being brought to bear on the decision-making process by the involvement of workers. Since workers see their workplace from a different perspective than architects, space planners and managers, additional aspects and points of view can be included that otherwise would have been neglected, which can result in improvements for the entire workplace.

Furthermore, the possibility of contributing to the design of one's workplace brings greater satisfaction for each worker. This results from bringing their own taste to bear on the design. Users then do not have to work in a place designed exclusively by architects, space planners or managers, but can develop their own style. This conveys to the workers that their personality is acknowledged even in the workplace, and that their individual needs are considered at least to some extent.

Finally, involvement in the design of workplace creates the opportunity for cooperation among workers. This cooperation of people, each with different responsibilities, contributes to the achievement of an optimal workplace, overall and for each individual user (Sundstrom & Sundstrom, 1986, pp. 232 et sqq.) A 1984 BOSTI study (cf. Walden, 1998, p. 272 ff.) illustrates the relationship between user workplace design and satisfaction with the environment and work. It showed that those workers who were able to participate in the design of their workplace exhibited a higher degree of satisfaction with work and workplace than those whose workplaces were designed exclusively by the architect, managers, and space planners.

We think that these findings can be applied to school environments as well, since there too, the creation of an optimal work and learning atmosphere which benefits well-being and performance motivation is a paramount concern.

Through user design, children and young people can express their identity and creativity, as well as demonstrating these to others. Only such user design will result in the desired identification of users with the school and classroom; only this will allow them to feel connected to the spaces. Design by students can involve the entire school grounds from the school yard to individual classrooms and their decoration and furnishing. It may be possible to reduce cost, because user needs are clearly defined. This makes an optimal learning environment possible.

3.9.7 Creating a Stimulating Environment

What does it mean to create a stimulating environment? Spaces should be designed so as to be associated by users with positive feelings such as well-being and satisfaction, as much as possible.

A stimulating environment can be achieved relatively easily in one's private realm, an apartment or house. But in public environments this is more difficult because different people perceive the environment in different ways, because many different characters come together in such spaces, and because one "cannot argue about taste." What is perceived as pleasant and stimulating by one person may not be appealing to another at all. It is therefore necessary to investigate preferences of users of public spaces. With the help of checklists of objective environmental features and subjective user assessments it is possible to identify common user expectations, even those of school children.

"A successful fit between user preferences and spaces design manifests itself in higher subjective user satisfaction rates. But this can only happen if there is a conscious effort to achieve a good fit between user needs and the built environment" (Walden, 1998, p. 75).

3.9.8 User Initiative

Equally significant is user initiative on the part of teachers and students. This means not only to make decisions regarding the design of the environment but also to actively become involved in their implementation. An example is the art instruction project at the Martin-Luther School in Wittenberg which led to the successful cooperation between teachers and students with the artist Friedensreich Hundertwasser (see project examples from Germany in this book). Such initiatives are all too rare in public buildings. Though such initiatives could prevent planning mistakes and save cost, opportunities for this are hardly ever offered.

A problem is certainly the fact that the future users of public buildings are seldom known at the time of planning. So who would be expected to take initiative, if a project does not concern private interests?

3.9.9 Self-Control and Self-Motivation

Schools cannot remain remote from the changes in technology and society but must respond to those changes. A rhythmic pattern in the planning of daily activities, differentiated organization of learning processes, working with relevant content issues that cross subject boundaries, early entry into foreign languages are challenging offers. New concepts aim at responsible self-organization of the learning process. The school's mission as a learning institution is to consciously tackle its own evolution and development. Here, educational goals, contents and sequences, methodological aspects and requirements and organizational issues become dominant and assert their place on the agenda of teacher conferences. Comprehensive conferences including representatives of parents and students are called for. Such comprehensive conferences set and define the guiding ideas for instruction and the life in the school. They initialize the school's further development by identifying the user needs, and react in a timely manner.

Schools must change! The determining factor is the diversity of student biographies, which should be seen as enrichment of the learning environment school but requires flexible working patterns. This breadth and diversity calls for school-specific criteria and for perspectives and efforts that are subject to constant critical reflection. Challenges are acknowledged, but that alone is insufficient. Questions such as the following are becoming urgent:

- How do we achieve a strengthening and sheltering atmosphere in our school?
- Do we have our own ideas and ways to achieve progress together?
- Are we on the road to success with our students?
- Are we recognizing and acknowledging obstacles, detours, borders and fruitless dead-ends?
- Are we allowing our children to actively contribute, are autonomy and independence encouraged?
- Is there too much frantic activity and not enough sheltering?
- Is careful attention given to the needs and claims of individual students?
- Who is really at the core of the instruction?

The answers to these questions then call for conclusions and consequences, as the driving force for the development of individual concepts for each school. Internal control mechanisms must be in place to develop further starting points and motivation for innovation.

When schools are changing, attention is first focused on curricula, instructional methods, and performance measures. Shifting the view to spatial resources, the social forms of the meeting spaces of students come into focus, that is, the school building itself, and the classrooms. Changes call for consequences in the building, leading to demands for space dividers in the form of cabinets, shelves, extension of movement spaces into the hallways, opening new doors to neighboring rooms, shifting instruction into the library or into a sheltered corner of the school yard, and the seeking out of additional spatial resources. Contemporary instruction involves movement and stimulation and a stimulating environment with easy access to learning resources. Blackboard, maps and slide projector are no longer the sole cornerstones of instruction. Architects should accept these challenges and write up their responses to this dynamic in a feasible plan. At the beginning of the twenty-first century, the requirements of contemporary education reflecting individual initiative and control, self-guided learning, school autonomy and concrete work, are calling for intelligent solutions.

Self-guidance and self-control are corresponding variables and require space for design and development. Otherwise, needed improvements in the following changing fields are not achievable, in our opinion:

- school culture
- learning culture
- adequate individual support
- readiness for team work
- cooperation
- impulses for further development
- readiness for lifelong learning.

Self-evaluation, much discussed in the literature, is possible only on the basis of constant reference to the past. Natural and systematic learning mature in the motivated learning process. This process is served by a stimulating environment and open spaces with corners, niches, seating groups and group tables, retreat corners, "favorite spots," the window seat, the chair with a standing lamp, the place at the computer. New rhythms and learning phases shake up the old image of classrooms. Spatial resources become dominant while the class "spreads out," – an aspect that should be guiding the work on new school planning and renovation alike.

3.9.10 Appropriation

Appropriation is understood as a process of "turning the objective environment into a personally and subjectively meaningful environment" (Werner, Altman & Oxley 1985; cf. Walden 1998, p.63). "Appropriation is the result of the freedom to move around freely in a room, to relax, to take possession of it, to feel, admire, dream, get to know, to do something in a place according to one's own wishes, needs, expectations and ideas" (Chombart de Lauwe, 1977, p. 6). Appropriation is a special form of "goal-oriented behavior, an interactive process in the man-environment relationship, to make something one's own, to take possession of" (Chombart de Lauwe 1977, according to Walden, 1993, p. 70). But even a learning process can be seen as appropriation: The students have successfully appropriated the learning material.

However, we would like to stay with the architectural psychology understanding of "appropriation." In the discipline lingo, appropriation is defined as having one's own forms of environmental control, to take possession of the environment, to use it, to endow it with meaning, and to be able to change it according to one's own requirements (Lynch, 1976 p. 35).

Appropriation creates the condition for people to identify with their environment. This also can be seen in schools. It occurs not only by changing spaces but to set boundaries between different realms. Users can appropriate a space through user design, participation, making choices, and at best, through the ability through individual planning. "The visible traces of the appropriation process are closely associated with the image of home" (Donnelly, 1980, p. 30; Walden, 1993, p.71). They are used to express the message "This is where I would like to be." Vandalism is a negative form of appropriation. The more architecture is open for appropriation, the easier it is to avoid planning mistakes. This calls for flexible spaces. Especially in schools, the rooms should be designed so as to make appropriation by students and teachers possible, for example by effortless implementation of open instruction methods.

Appropriation can be initiated by individuals as well as by groups, and thereby enhance social interaction and well-being. "To the extent a person appropriates something in the environment and makes it his or her own through use or further adaptation work, the object will reflect the activity of that person. These efforts are increasingly accompanied by feelings of belonging and, according to success, of satisfaction" (Graumann, 1996).

3.10 Ecological Aspects

Ecologically successful buildings lead to physical well-being in and around them, from the beginning of construction all the way to demolition (cf. Walden, 2006). Economical use of resources is a part of this, with suspected indirect consequences for the well-being of future generations. Lorsch and Abdou (1994; cf. Clements-Croome, 2000, p. 12) cite higher density of occupants in buildings than initially intended, mistakes in the ventilation system, the use of toxic materials in construction and renovation, leaking water pipes, condensation as causes for the "sick building syndrome" that has been blamed for a variety health problems in occupants. Reduced productivity and performance is associated with such construction problems (Burge, Hedge, Wilson, Harris-Bas, & Robertson, 1987).

3.10.1 Odors

Odors are subjective experiences. Odor perceptions are caused by chemical substances in the air that are sensed by olfactory cells in the sinuses. Odors such as sewage treatment plants near schools, or restrooms in the immediate vicinity of classrooms can become nuisances. This certainly will affect the well-being of teachers and students negatively. There is even talk about the specific aroma of the air in schools.

In recent years, aromatherapy has enjoyed increasing popularity. One can find artificial fragrances even in many classrooms, for which various claims as to their effects are made.

Studies have confirmed that certain fragrances such as flower scents and lemon fragrances can cause better attention, enhanced well-being, and higher performance (Baron & Thomley, 1994). In this, it must be kept in mind that odors are always subjective perceptions, even if there are claims of general ascribing uniform effects to many smells. It seems to be better if children have the opportunity to perceive and associate smells in nature. This is in line with the greater importance attributed to the various sensory experiences by open instruction methods. Our sense of smell is also very adaptable. After spending some time in a poorly ventilated room, we hardly notice the worsening odors any more.

The substances causing odors are chemicals. Industry is considered the main source of such substances, but they are also generated by agriculture, traffic, and other human activities. Increasing numbers of people feel aggravated by smells and complain to the authorities.

Field studies and lab experiments have determined that cognitive abilities are affected by unpleasant odors. They even have been shown to cause reduced motivation for work, and longer time required for visual search tasks. Therefore, further impacts on moods and aggression behavior cannot be excluded (cf. Homburg & Matthies, 1998, p. 110). In public buildings, care must be taken to avoid annoying odors. Schools are public buildings, and call for the same hygienic sensitivity.

3.10.2 Walls

Distinctions must be made between exterior and interior walls. In addition to possible load-bearing functions, exterior walls serve as climate protection. They must shelter the interior from rain, cold and heat, frost, strong winds, excessive solar radiation, resist interior humidity, and store heat. In addition they have to provide noise protection. For exterior walls, the choices are between:

- solid one-shell walls,
- double or multi-shell walls
- walls consisting of frame and shells (Pott, 1993, p. 54).

Solid single-shell (homogeneous) walls have the advantage of not only providing thermal insulation but also storing heat. They are simple, usually inexpensive to build and not very susceptible to damage. For such walls, wood, brick or light (aerated) concrete are the materials of choice. In walls with multiple shells, the different layers – usually outer skin, insulation, inner skin (with vapor barrier membranes between the layers), can be constructed with the most appropriate material for each of the respective functions. For walls where load-bearing posts and frames alternate with the infill skin, care must be taken to avoid thermal bridges and cracks between the different materials that could let humidity penetrate into the interior. In all exterior walls, the required characteristics for thermal insulation, humidity barrier, protection against solar radiation, thermal storage, wind resistance and so on have to be carefully matched to the local climate and other conditions (such as earthquakes) and executed with appropriate care. This is the professional task of the architect. In most countries there are governmental regulations covering these aspects which of course must be met.

With respect to internal walls and partitions, distinctions must be made between load-bearing walls and non-load bearing walls that merely provide visual and acoustic separation between rooms, with acoustic separation usually requiring more attention. Special provisions for thermal insulation are not necessary, but just like the exterior wall, the internal partition are often expected to store heat and absorb humidity, gases and odors so as to create a good climate in the rooms (ibid. p. 50).

The heavier a wall, the better it can absorb noise; homogeneous massive brick or limestone walls are best suited for this purpose.

A healthy microclimate in the rooms depends not only on the choice of building materials but also on the treatment of the wall surface: stucco and paint. Wall surfaces should not be hermetically sealed but remain able to 'breathe', that is, able to absorb humidity and gases; they should not give off toxic gases, be electrostatically neutral, and elastic. In certain hot-dry climates, adobe is a very appropriate, inexpensive, natural and healthy material for walls (Schillberg & Knieriemen, 1996). In public buildings especially, synthetic stucco materials should be avoided. They are inappropriate from the point of view of healthy building and require extreme care in execution; mistakes (cracks) will lead to the formation of toxic molds, and constitute health and environmental hazards from production to demolition and disposal.

3.10.3 Floors

Throughout the day, the part of buildings with which people come into most frequent contact are the floors. Therefore, attention must be directed not only to the criteria "pleasant, healthy and beautiful" but also to characteristics such a elasticity, thermal behavior, noise generation from walking, and electrostatic behavior. Many health problems such as allergies and colds are caused by inappropriate, cold flooring materials.

The most important flooring materials (ibid., p. 78) are:

- stone and tile
- wood
- textiles (carpet)
- plastic (e.g., vinyl)
- linoleum – cork.

There are advantages and disadvantages associated with each of these, so it is necessary to gather adequate information before deciding which material is the most appropriate for the respective building task. To sensitize the feet it is recommended to avoid monotony and vary the flooring materials throughout the building.

The floor is the most important contact surface to the body, via the soles. These are the key receptors for the central nervous system. Smooth unstructured floors do not sensitize the nerves (Busmann, personal communication, June 7, 2005; cf. Kükelhaus, 1984). In our opinion, wood floors are a good choice for most purposes.

They still have a favorable price-performance relation, as a natural, biological material, with good absorption and diffusion properties which contribute to a favorable microclimate. Wood floors also are considered less flammable and do not produce a lot of toxic fumes in case of fire (cf. Pott, 1993, pp. 78–79).
Waldorf schools feature wood floors. We have seen such floors in classrooms and determined that the wood floors give the rooms greater warmth. We do not know of any studies of the relationship of flooring materials to well-being, but we think that the choice of flooring material does make a difference in people's well-being.

3.10.4 Decks and Ceilings

Decks and ceilings don't just serve the purpose of carrying and distributing loads, but also to mitigate noise (mainly impact noise from walking) and protection from heat loss and humidity. In Germany, the standard decking construction is the reinforced concrete slab, which does it structural jobs with relatively small thickness, is fire-resistant and not susceptible to humidity (Pott, 1993, p. 71). But reinforced concrete slabs are not needed in most cases. They have several disadvantages such as a long curing and drying period, poor ability to regulate humidity, and are held to interfere with the natural radiation and magnetic field of the earth (ibid., p. 71).

3.10.5 Energy Conservation and Economic Aspects

Other than a few earlier, farsighted pioneering projects, serious steps towards energy conservation were only started in Germany after the so-called oil shock of 1973 (Eissler & Hoffmann, 1988, p. 18). Provisions for energy conservation must begin with the planning of houses and public facilities. The following aspects are considered suitable conditions for achieving minimal energy consumption:

- orientation of the building to the sun
- avoiding thermal bridges in the exterior skin
- use of thermal insulation glass so as to achieve a heat transfer coefficient of at most 1.5 W/(m2K)
- few windows facing away from the sun (north in northern hemisphere)
- insulating shutters
- appropriate orientation of spaces towards the sun
- consideration of different temperature zones in the building
- controlled ventilation with heat recovery
- as much as feasible, consideration of solar, wind, or geothermal energy (Pott 1993, p.58).
- careful caulking of insulated construction to avoid draft – installation of efficient heating and cooling equipment.

All hot water pipes and boilers and water heaters should be placed inside the thermal skin of the building to save heating costs (StoJournal 2/99, p. 3). Energy costs of building operation can always be kept to more favorable levels, the more compact the building form.

The public should be motivated to better energy conservation. Incentives for investing in energy-conserving building should be put in place. “The introduction of energy consumption figures is a step forward. These numbers measure the actual, climate-de-pendent energy use per square meter of floor area. Their use should be made mandatory as an ‘energy pass’ to provide incentives for reduction of energy use and control of heating equipment and user behavior. The energy use figures provide the needed information for this. Energy passes are the key vehicle for the implementation of the new energy conservation legislation EnEV (Energie Depeche Nr. 3, 1999, p. 26).

Ecological aspects for energy conservation in buildings were discussed above. The following are some other ecological measures that can contribute to creating schools as ecological learning environments:

- active and passive use of solar energy
- soil protection – reducing impermeable surfaces to improve retention and absorption of rain water into the soil; use of rain water
- reuse of “gray water”
- use of sodded roofs
- ecological heating technology – using wood chips, pellets, soil temperature
- separation and recycling of different waste materials, composting (cf. Maurer & Maurer, 2003).

3.10.6 Design of Outside Areas, School Grounds

Every new building constitutes a drastic intervention into nature which can only be partially remedied by massive replanting, with hedges, trees nature meadows, flowers and vines. Plants near or on buildings bring many advantages:

- they buffer climatic variations
- their shade prevents extreme heating up of buildings and streets.
- they cleanse the air of dust and other impurities;
- they increase humidity as well as oxygen content of the air
- they offer a habitat for birds, bugs, butterflies and insects, which may bring children a broader experience of nature
- they contribute to the protection of the building and are an effective and economical sun screen (Pott, 1993, pp. 193–199).

These advantages must, in fairness, be balanced against some disadvantages that might be more critical in some countries than others. In areas affected by termites, plants near the house increase the danger of infestation. Vines are potentially damaging to some forms of exterior skin, they can enter cracks and later expand, breaking material and allowing insects and humidity to enter.

Deciduous trees provide effective protection from the sun in the summer, especially near windows facing the midday sun, while allowing warming sun rays to enter the building during winter months (ibid., p. 193).

Plants don't just provide protection from the sun but also from wind. Where there is no vegetation nearby, strong winds can severely cool down buildings and lead to increased energy consumption. "Besides these obvious (functional and economic) advantages we should not forget that plants also contribute to spiritual well-being" (ibid., p. 149).

To achieve the best possible results in landscaping school grounds, the design should best be carried out in the form of a project. Plants must be chosen in relationship to the areas where they will grow. In many cases, fences can be omitted by instead planting living boundaries in the form of hedges. To improve the experience of nature for children during recess, it would be great if space could be found for a pond or wetland area. Each class should be given its own garden plots; this would lead to a better understanding of natural ecological cycles. But not only planting should be considered for school grounds. There should be zones for encounter that support social togetherness. For this, seating might be appropriate that students have produced in workshop classes. Children must have the opportunity and space for movement during the breaks. This might not only involve basketball courts and soccer fields but also the kind of playground equipment designed for children by Hugo Kükelhaus. It is essential that such spaces are created with the involvement of the children themselves; they also should be actively involved in their care and maintenance.

In the literature (Winkler, 1999), six different functions of exterior areas in schools are distinguished, each with their own spatial requirements:

1. Space for movement. Spatial requirement: play areas with equipment, play landscapes and building playgrounds;
2. Free play areas. Spatial requirement: Areas unsupervised by teachers; no playground equipment that mandates play; multifunctional spaces;
3. Rest and regeneration areas. Spatial requirement: quiet, remote areas that can serve as retreat and observation spaces, visually appealing spaces with flowers;

4. Contact and meeting spaces; social learning space. Spatial requirement: classical meeting spots. Not organized according to age groups but function; possibilities for redesign.
5. Space for experiencing nature. Spatial requirement: areas with many different plants and wildlife, wetland areas, nature trails, school garden; natural areas without museum character;
6. Instruction areas. Spatial requirement: Stimulating and varied open air areas suitable for teaching.

3.10.7 Environmental Education

In Germany, environmental education is now recognized as a basic component of a future-oriented education. This was not always the case. There has been a growing interest in this topic only since the 1970s. Research indicates that knowledge about nature and the environment is conveyed more effectively by schools than through mass media or parents (cf. Eulefeld, 1996, p. 657). "Only when children come into early intensive contact with nature, will they become actively engaged in the protection and conservation of natural life resources later on" (Umwelt Journal 21/99, p. 38; Buddensiek, 1992). "School as learning and living space can promote the acceptance of new forms of perception, thinking and action" (Deutsche Gesellschaft für Umwelterziehung [German Society for Environmental Education], 1995, p. 24.)

In recent years, much progress has been achieved in environmental education in schools. But there is still much to be done to further open up the road from theory toward practice. We have the knowledge; now action is needed. Today, practices such as recycling are common in almost all schools, rainwater is being collected and reused for irrigation of flower beds. "The school is a rich space for experience in which new behavior patterns can be practiced and become firm habits for the future" (ibid., p. 24). Precisely for that reason, all schools should offer more opportunities for responsible environmental behavior. Environmental education should be firmly anchored in the educational mission and in the curriculum of schools.

The decisive question is, however, how instructional practices can be redesigned so as to accommodate the full, cross-disciplinary, practice- and action-oriented challenge of environmental education. Today, it is offered on a more or less regular basis only in some subject areas: in biology, chemistry, geography more so than in physics, religion, technology/trade instruction, economics and politics and home economics. But specific methods such as cross-disciplinary investigations and independent study by students are still relatively rare (Eulefeld, 1996, p. 657).

Students today come into contact with the topic of environmental protection primarily through team projects or project weeks. But this is not sufficient; a more practice-oriented approach to motivating them is needed. Topics such as "climate," "rain forest destruction," "ozone," "water pollution," and the like can be conveyed through direct experience only in rare cases. They must be made transparent, their problems should not be relativized but presented and demonstrated with factual competence. In this, cooperation with environmental protection centers would be desirable, and considerable commitment on the part of teachers is needed. Environmental education is an irreplaceable component of a proactive environmental policy. Appropriate educational concepts must be developed, so as to allow information, enlightenment and education to play their central role in supporting sustainable development and human ability to solve environmental and development problems in a coordinated and timely fashion. These ideas are so important that they should guide the planning of new schools both from an educational as well as the architectural point of view. Environment should be seen as not "out there" but actually "our world."

3.11 Organizational Aspects

At the occasion of inauguration of a new school and the handing over the key by the architect, various instructions for its use and operation may be discussed: how windows are to be opened, how to operate the blinds and the ventilation equipment; the various entries and exits and access to specialty rooms. Issues of fire safety and provisions for security may be praised as exemplary solutions. But all that has nothing to do with the real acceptance of the building.

For genuine acceptance by the users, the key aspects are the pleasant and livable character of the spaces, their friendly and welcoming atmosphere, the appealing color scheme, the renunciation of monotonous linearity of the building, and the smooth organization of the daily routines. Of course the above aspects are important, but they should not be so predominant as to result in overwhelming signage and regimentation of every little detail. To become familiar with a place means to explore, to get to know, to accept, to feel at home in it. If children are to spend more than 1,000 hours a year in a building, familiarity does not have to be achieved with excessive signage. Reserved symbolic signage, arranged exploration tours, including introduction to proper behavior in case of fire or emergencies can all be done in reality-oriented ways appropriate to children.

3.11.1 Ease of Access

There are several aspects that must be considered with respect to access and orientation in a school. They involve on the one hand the layout and placement of entrances and staircases, and the provision of signage and symbols for orientation on the other. Both will facilitate student orientation in the building, avoiding stress and increasing well-being. Where we know our way around, we feel at home and safe.

3.11.2 Placement of Entrances, Staircases, and Specialty Rooms

The educational innovation of teaching children with various disabilities together with those without disabilities is by now taken for granted as the standard practice for the future. In some states, this integration has been mandated by law. But it requires that all spaces in schools must be easily accessible to all; ramps and elevators must be provided so that nobody will be excluded from access to any space.

Entrances should be easily recognizable, visible, and covered. If there are several entrances, these must be identified appropriately. To enable access for people in wheel-chairs, the doors must be wide enough and equipped with automatic door openers or easily operated sliding doors. These considerations do not imply that there should be no more staircases in schools. According to Kükelhaus it is especially the damaged organ or limb that should be exercised, as much as the nature of the damage or disability permits.

Stairs are important in all schools. Hugo Kükelhaus emphasizes this when he says: “It is difficult for children to keep from hopping and skipping when they walk. And they love to run up and down the stairs. Their life, life in general, is three-dimensional movement. But in schools, the children are forced to behave like crawling animals, in one or two dimensions! Half of any school; any educational buildings, should consist of stairs. Learning and teaching are sequences of steps” (Münch, 1998, p. 69). The architectural concept reveals the placement of stairs. Likewise, the placement of specialty rooms is a decision for the architect and the future users. There are no universally valid rules for this, nor are there any studies about positive or negative consequences of certain arrangements. In our examples we describe several schools that have exemplary classrooms at ground level, with barrier-free access to the outside and where specialty rooms are accessible via ramps – for example the Protestant Comprehensive School Gelsenkirchen. In the multi-story core, an elevator for people with disabilities is a matter of course.

3.11.3 Signage and Wayfinding

A criterion for assessing the quality of environments is the ease or difficulty of orientation and wayfinding. This is facilitated on the one hand by our sense of orientation and on the other hand by well visible signage. But the key factor in buildings is the clarity of the architectural arrangement of spaces, hallways, exit routes and zones. Signage must be seen as necessary mainly to the extent this clarity of the architecture is lacking. The more familiar people are with their building or environment, the more intensively they develop mental representations of the spatial relationships between its components.

Orientation in schools means easily visible signs and orientation aids that help students, teachers, and other users to easily find their way in complexes that often consist of several buildings and wings. Signage can be of crucial importance especially in emergency situations. It means not only the identification of every room and its purpose, but especially the marking of emergency routes and exits which can be of lifesaving importance. Signage should help new students find their way around quickly and become familiar with the building so as to feel at home there sooner. But the current trend takes a different direction, based on the idea that students should devote some effort to exploring their school house. This was the intention of the architect of the Heinz-Galinski School in Berlin-Grunewald, Zvi Hecker. He created labyrinthine sequences of spaces with curved, cavelike passages (called “snakewalks” by the children) “which makes curiosity, exploration, and discovering it an adventurous challenge in this little autonomous town” (Weachter-Böhm, Internet 1996, keyword: Heinz-Galinski Schule). Whether this approach is appropriate for children in emergency situations is something we can only hope will not have to be learned in the test of a real emergency.

3.11.4 Safety and Security

“Security” is a wide concept used not only to describe and explain the man-environment relation, but also for the purpose of characterizing environments (Flade, 1998, p. 60). In the following, “safety” will be used to discuss building, technical and environmental aspects related to the prevention of accidents. “Security” will be used in connection with the occurrence of aggressive and criminal behavior, robberies and the like. An environment, a building or building part such as a railing is said to be secure if there are few crimes and robberies occurring there. An area is considered safe if there are technical provisions for user protection against fire or earthquakes, for example. As part of his framework of 33 essential design principles for school design, Lackney (2000) proposes to separate the movement zones of children and pedestrians from those for vehicles and delivery.

These considerations are also mandated by governmental regulations for school construction. Ignoring or violating these in planning buildings can have fatal consequences. The lives of users are recklessly put at risk. Safety provisions range from the choice of building materials to the installation of fireproof doors and emergency exits and stairs. These items must be easily recognizable and clearly marked.

The objective safety of a place or area can be measured by means to the accident and crime statistics. But the objective facts and subjective impressions do not always match (ibid., p. 60). Safety regarding man-environment relations involves the objective likelihood of accidents and crimes, the perception by users of the environment as a safe or unsafe one, and the attitude of users towards their environment. A person who is convinced of the safety of the environment has confidence in it. According to McKechnie (1977) this implies a general openness and sensitivity toward the surroundings, and confidence in one's ability to find one's way around in the environment, in addition to the feeling of being protected.

3.12 After-Hours Use of Schools

After-hour use means that schools are not just open for the regular daily users, but also for others. Schools and school grounds can be put to a variety of uses by the local and regional community.

3.12.1 Opening the School to the Community

What does "opening the school" mean? Three interpretations are possible: "For one it could mean to open the instructional process to the individual activity and independent work of each student. Secondly, to open the instructional process, reorganize it in terms of crossing boundaries between disciplines and subjects, in terms of projects that are integrated into a differentiated school life. The third concern is to open the school to the community. This should not be a one way street! It should not just consist of the occasional field trip or orientation visit, or an internship experience, but also inviting experts, parents, politicians, alumni back into the school for discussions, to participate in projects, and on the whole enrich and enliven the instruction" (Meyer, 1989, p. 420; cf. 1999).

When the results of teaching and projects get back to the public, students and teachers alike will earn criticism and praise. New possibilities are opened up. With successful work, the school can become involved in public discourse about issues like environmental policy, working for peace, local politics, cultural issues, sister city partnerships and so on (ibid., p. 420). It was shown in many such projects that this is possible and does not have to lead to a party-politically uniform society. The learning goal is to have students themselves contribute to create the public sphere.

But the concern is not only for students to be able to present their activities to the public, but that the community should be given the opportunity to use the school facilities for events and activities in the evenings and holidays. The school should not only be a place for learning but an open house where everybody can feel at home.

3.12.2 Inclusion of Community and Educational Institutions

The opening of the school brings about entirely new connections to the community. Many principals have succeeded in persuading local sports clubs to offer special instruction and event s for their sports in schools. Adult education course are offered, which include computer instruction, swimming lessons, typing and shorthand, as well as foreign languages. The school yard as well should not only serve the students during breaks between classes but be available in after school hours as an attractive play area (Flade, 1998). For example, on the grounds of the Waldorf school in Cologne, the students themselves built half pipes for skateboarding and inline skating, which now are used not only by students of the school but by youths from the surrounding community. This not only facilitates the formation of new friendships and acquaintances but also counteracts vandalism by outsiders.

Open paved areas in the school yard can be marked to form a bicycling track. This enables children to use their bikes in their free time in a safe area.

The school grounds should be a place where young and old can meet and celebrate. Assembly halls or auditoriums of schools should be used for community events as well. Only through such processes with the school be integrated into the community.

3.12.3 Adult Education Centers

In Germany, the number of children has been sinking steadily in recent decades: “in more than 50% of German families, children grow up as only children without siblings” (Der Spiegel Nr. 35, 1994, p. 41). This fact suggests that in planning schools, the possibility of future changes of use of the spaces should be included in the consideration. In other words, the schools should have flexible spaces that can be used for different purposes not only currently (different uses within the school) but entirely different uses at some future time. Economic reasons support “current” multifunctional uses: different uses may help in covering operating costs, but also reduce the need for constructing several facilities for almost identical purposes.

Schools are the ideal venue for evening courses of adult education. After all, why should parents and other adults not use the spaces where children learn during the day to pursue the same activity in the evenings? Of course, the library, school kitchen, work-shops, computer and media labs, and archives are used for such events. In many places the “Open Channel” has taken up work in schools and enjoys lively attendance. In this way, children and adults have a common house serving the same purpose of lifelong learning.

School resources working in this way for public communication centers also increase participation and engagement of the public in local affairs (Lackney, 2000). The hallmark of future schools will be their service character with emphasis on inviting, lingering, learning, taking part.

3.13 Conclusion

Perhaps we will never achieve the school of the future, because something always could be done better. In this chapter we discussed a number of spatial conditions that have considerable significance for the design and remodeling of schools. Color scheme, proper lighting, a good room temperature and ventilation, control of noise and good acoustic conditions, as well as appropriate furniture all contribute to the well-being and motivation to learn in students, teachers, and other users.

Schools as public buildings are used by many people of different age groups. It is therefore important to find design solutions that take the concerns of all affected users into account. This is not an easy task, and it is therefore advisable to seek the help of experts to create a harmonious, friendly and pleasant learning atmosphere.

We also tried to describe processes and needs that are important for the well-being and social interaction of users. User identification with the school house is extremely important. The condition of identification is participation in the decision-making so that personal concerns are considered. Only then can users feel at home in the building, and aggression and vandalism are not given the chance to spread.

User design and appropriation by students is essential. These processes give students the opportunity to interact more directly with their learning environment and to identify with it. This not only increases well-being but also motivation to learn and perform.

The possibility of having areas of privacy into which users can retreat is also important. While the class community as a group has this opportunity in the form of the classroom, the need of individual students to occasionally retreat into a more private sphere has not received sufficient attention. While obviously students cannot be given their own room, it should be possible to provide small niches or galleries that offer partial privacy. It was also shown that the architecture of the building, inside as well as outside, is significantly influencing later different uses. Organizational aspects such as the arrangement of spaces, movement routes especially for emergency evacuation, signage and safety provisions influence the impression of the school.

Ecological considerations should find special consideration in school design, since this determines the health conditions of the building. Building materials should be chosen with care; they should if possible be of local origin, environment-friendly and above all not potential health hazards. Environmental education which in Germany is accepted as an integral part of the educational mission must be presented in a competent and appropriate manner, supported by the spatial design and other resources of the school that reinforce the instruction. Future-oriented education also must include expanded forms of instruction such as station learning and workshop instruction, where the actions and personality of each student take center stage.

After hour uses of school facilities bare becoming more and more important. New connections to the community at large are emerging, not only through evening course for adult education and special events for adults. The school is becoming more attractive not only as a place for learning but as a home for play and activities for children in their free time after classes.

As further sources about school planning we recommend the following surveys: Ahrentzen, Jue, Skorpanich, and Evans (1982); Brubaker, Bordwell, and Christopher (1998), Dudek (2000), Gifford (2002), Gump (1974, 1978, 1991); Hellbrück & Fischer (1999); Linneweber (1996); Rivlin & Weinstein (1984); Ströhlein (1998).

Among other things, these publications attempt to develop frames of reference and models for environment-behavior relationships in school environments. Based on numerous studies, Ahrentzen, Jue, Skorpanich, and Evans (1982) developed a taxonomy for the study of stress in elementary school settings. In the 1970s, avoidance of stress was a prime concern, more so than the support of performance and creativity. In many cases, environmental impediments do not affect performance directly, but they are reducing satisfaction and well-being.

The taxonomy of Ahrentzen et al. (1982; cf. Moos, 1979) is based on the concept of "fit" between personal characteristics and environmental features. According to Ahrentzen et al., students are willing to devote more effort to difficult tasks in settings that support their expectations and needs. The concept of "behavior setting" by Barker (1968, 1978) was used by Gump (1991) to define the main factors of his analysis as physical setting (architecture, interior design), roles (for example learner-teacher), and behavioral programs. Barker is more concerned with the synomorphy between the three components. Gifford (2002) mentions almost the same relationships between the personal characteristics of learners, the physical features of the learning setting and the social-organizational climate of attitudes and behaviors involved in learning.

Special studies are concerned with special topics, for example large and small schools (Barker & Gump, 1964), open versus traditional schools (Gump, 1974), "soft classroom" (Sommer & Olsen, 1980), the school and classroom climate (Anderson, 1982; Arbinger & von Saldern, 1982; von Saldern, 1992), and the lab school Bielefeld (Schmittmann, 1985).

References

Ahrentzen, S., Jue, G.M., Skorpanich, M., & Evans, G.W. (1982). School environments and stress. In G.W. Evans (Ed.), Environmental Stress. New York: Cambridge University Press.

Altman, I. (1975). The environment and social behavior: Privacy, personal space, territoriality and crowding. Monterey, CA: Brooks/Cole.

Anderson, C.S. (1982). The search for school climate: A review of research. Review of Educational Research, 52, 368–420.

Arbinger, R., & von Saldern, M. (1982). Schulische Umwelt und Verhalten von Schülern. Forschungsberichte aus dem Forschungsprojekt Sozialklima [School environment and student behavior. Research reports from the social climate project]. Landau: Zentrum für empirische pädagogische Forschung der EWH Rheinland-Pfalz.

Asztalos, A. (1981). Schule kaputt? Warum in Schulen vieles zerstört wird und was wir dagegen tun können. [School's broken? Why there is so much destruction in schools and what we can do about it]. Hanover: Niedersächsischer Kultusminister.

Barker, R.G., & Gump, P.V. (1964). Big school, small school. Stanford: Stanford University Press.

Barker, R.G. (1968). Ecological psychology. Concepts and methods for studying the environment of human behavior. Stanford, CA: University Press.

Barker, R.G. (Ed.). (1978). Habitats, environments, and human behavior. Studies in ecological psychology and eco-behavioral science from the Midwest Psychological Field Station, 1947–1972. San Francisco, CA: Jossey-Bass.

Baron, R.A., & Thomley, J. (1994). A whiff of reality: Positive affect as a potential mediator of the effects of pleasant fragrances on task performance and helping. Environment and Behavior, 26, 766–784.

Becker, F.D., Sommer, R., Bee, J., & Oxley, B. (1973). College classroom ecology. Sociometry, 36, 514–525.

Bell, P.A., Greene, T.C., Fisher, J.D., & Baum, A. (1996). Environmental psychology (4th ed.). Fort Worth: Harcourt Brace.

Berquet, K.-H. (1988). Sitz- und Haltungsschäden. Auswahl und Anpassung der Schulmöbel [Seating and posture problems. Selection and adaptation of school furniture]. Stuttgart: Thieme.

Brill, M., Margulis, S., & Konar, E.; for Buffalo Organization for Social and Technological Innovation (BOSTI). (1984). Using office design to increase productivity, Vol. I and II. Buffalo, NY: Workplace Design and Productivity, Inc.

Brubaker, C.W., Bordwell, R., & Christopher, G. (1998). Planning and designing schools. New York: McGraw-Hill.

Buddensiek, W. (1992). Schule der Zukunft [School of the Future]. Neue Deutsche Schule, 44(13/14), 10–16.

Buddensiek, W. (2001). Zukunftsfähiges Lernen in Häusern des Lernens. [Future-oriented learning in houses of learning]. Göttingen: Werkstatt.

Bullock, A., & Foster-Harrison, E. (1997). Making the best decisions: Designing for excellence. Schools in the Middle, 7(2), 37–39, 60–61.

Burge, S.A., Hedge, A., Wilson, S., Harris-Bas, J., & Robertson, A. (1987). Sick building syndrome: A study of 4,373 office workers. Annals of Occupational Hygiene, 31, 493–504.

Busmann, P., & Haberer, G. (1996). Eine Architektur für die Sinne. [An architecture for the senses]. Berlin: Ernst & Sohn.

Busmann, P., & Haberer, K. (2005). Projektbeschreibung zur Gesamtschule Brühl-Süd. (Project description of the comprehensive school Brühl-South).Retrieved from www.busmann-haberer.de/bauten/index.php on September 30, 2005.

Butin, D. (2000). Classrooms. Washington, DC: National Clearinghouse for Educational Facilities

Chombart de Lauwe, P.-H. (1977). Aneignung, Eigentum, Enteignung. Sozialpsychologie der Raumaneignung und Prozesse gesellschaftlicher Veränderung [Appropriation, property, expropriation. The social psychology of expropriation and processes of social change]. Arch+, 34, 2–6.

Clements-Croome, D. (2000). Indoor environment and productivity. In D. Clements-Croome (Ed.), Creating the productive workplace (pp. 3–17). London: Spon.

Collins, B.L. (1965). Windows and people: Alternative survey. Psychological reactions to environments with and without windows. National Bureau of Standards Building Science Series, No. 70. Washington, DC: Institute for Applied Technology.

Cotton, K. (1996). School size, school climate, and student performance. Portland, OR: Northwest Regional Educational Laboratory.

Dederich, M. (1996). In den Ordnungen des Leibes. Zur Anthropologie und Pädagogik von Hugo Kükelhaus [In the orders of the body. On the anthropology and pedagogy of Hugo Kükelhaus]. Münster: Waxmann.

Deutsche Gesellschaft für Umwelterziehung (1995). Modelle zur Umwelterziehung in der Bundesrepublik Deutschland. Bericht über eine Fachtagung des Bundesministeriums für Bildung und Wissenschaft, der Hamburger Behörde für Schule, Jugend und Berufsbildung, der Deutschen Gesellschaft für Umwelterziehung und des Instituts für die Pädagogik der Naturwissenschaften [Models for environmental education in the Federal Republic of Germany. Report on a conference of the Federal Ministry of Education and Science, the Hamburg Department of Schools, Youth and Vocational Training, and the German Society for Environmental Education] (pp. 24–25). Kiel: Cats graphic.

Dieckmann, F., & Schuemer, R. (1998). Kommunikation zwischen den beteiligten Gruppen. [Communication between participating groups]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 27–44). Darmstadt: Institut Wohnen und Umwelt.

Donnelly, D. (1980). Are We Satisfied with "Housing Satisfaction"? Built Environment 6(1), 29–34.

Dreier, A., Kucharz, D., Ramseger, J., & Sörensen, B. (1999). Grundschulen planen, bauen, neu gestalten. Empfehlungen für kindgerechte Lernumwelten (Jubiläumsband zum dreißigjährigen Bestehen des Grundschulverbandes) [Planning, building, and renovating elementary schools. Recommendations for learning environments suitable for children (Publication celebrating the 30th anniversary of the Elementary School Association)]. Frankfurt am Main: Arbeitskreis Grundschule e.V.

Dudek, M. (2000). Architecture of schools: The new learning environment. Oxford: Butterworth-Heinemann.

Eichholz, R. (1992). Die kinderfreundliche Stadt [The child-friendly city]. In W. Gernert (Ed.), Über die Rechte des Kindes. Impulse für die Jugendhilfe zum Schutz des Kindes durch Familie, Gesellschaft und Staat [On the rights of the child: Impulse youth help, for the protection of children by family, society, and government] (pp. 255–266). Stuttgart: Boorberg.

Eissler, H., & Hoffmann, W. (1988). Wohnbiotop. Energiesparendes Studentenwohnheim. Ein ökologisches Projekt an der Universität Kaiserslautern [Living habitat. An energy-conserving student residence. An ecological project at the University of Kaiserslautern]. Karlsruhe: C.F. Müller.

Energie Depesche (1999). Informationen für Energieverbraucher Nr. 3, 26–28.

Engel, O., & Dahlmann, J. (2001). Pädagogische Architektur [Educational architecture]. Unpublished thesis submitted to the State Examination Office for First State Examinations at Schools in Cologne as part of the first state examination for special needs education. University of Cologne, Germany.

Eulefeld, G. (1996). Umwelterziehung [Environmental education]. In L. Kruse, C.-F. Graumann, & E.-D. Lantermann (Eds.), Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen [Ecological psychology. A handbook of key concepts] (pp. 654–659). München: Psychologie Verlags Union.

Faust-Siehl, G., Garlichs, A., & Ramseger, J. (1996). Die Zukunft beginnt in der Grundschule. Empfehlungen zur Neugestaltung der Primarstufe [The future begins in primary school. Recommendations for the reorganization of primary education) Reinbek bei Hamburg: Rowohlt Taschenbuch.

Faust-Siehl, G., Garlichs, A., Ramseger, J., Schwarz, H., & Warm, U. (1996). Die Zukunft beginnt in der Grundschule. Empfehlungen zur Neugestaltung der Primarstufe [The future begins in elementary school. Recommendations for the reorganization of elementary education]. Reinbek: Rowohlt.

Festschrift Freie Waldorfschule Köln [Special publication celebrating the Free Waldorf School, Cologne]. (1998). (pp. 40, 56–61). Wuppertal: Offset Company.

Festschrift zur Wiedereröffnung des Martin-Luther Gymnasiums in Wittenberg. [Special publication celebrating the re-opening of the Martin-Luther High School in Wittenberg, Germany]. (1999). (pp. 1–9).

Flade, A. (1987). Wohnen psychologisch betrachtet [Dwelling from a psychological point of view]. Bern: Huber.

Flade, A. (1996). Kriminalität und Vandalismus [Crime and vandalism]. In L. Kruse, C.-F. Graumann, & E.-D. Lantermann (Eds.), Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen [Ecological psychology. A handbook of key concepts] (pp. 518–524). München: Psychologie Verlags Union.

Flade, A. (1998). Evaluation eines innerstädtischen Schulhofs [Evaluation of an inner-city school yard]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 243–247). Darmstadt: Institut Wohnen und Umwelt.

Flade, A. (1998). Privatheit [Privacy]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (p. 58). Darmstadt: Institut Wohnen und Umwelt.

Flade, A. (1998). Sicherheit [Security]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 60–61). Darmstadt: Institut Wohnen und Umwelt.

Flade, A. (2006). Wohnen psychologisch betrachtet [Dwelling from a psychological point of view]. Bern: Hans Huber/Hogrefe.

Fletcher, D. (1983). Effects of classroom lighting on the behaviour of exceptional children. EEQ: Exceptional Education Quaterly, 4, 75–89.

Fowler, W.J., & Walberg, H.J. (1991). School size, characteristics, and outcomes. Educational Evaluation and Policy Analysis, 13, 189–202.

Frieling, E., & Sonntag, K. (1999). Lehrbuch Arbeitspsychologie [Textbook psychology of work]. Bern: Hans Huber

Gifford, R. (1997). Environmental psychology. Principles and practice (2nd ed.). Boston: Allyn and Bacon.

Gifford, R. (2002). Educational environmental psychology. In: Environmental psychology. principles and practice (3rd ed.). (pp. 296–336). Colville, WA: Optimal Environments.

Glass, G.V., Cahen, L.S., Smith, M.L., & Filby, N.N. (1982). School class size: Research and policy. Beverly Hills: Sage.

Graumann, C.-F. (1996). Aneignung [Appropriation]. In L. Kruse, C.-F. Graumann, & E.-D. Lantermann (Eds.), Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen [Ecological psychology. A handbook of key concepts] (pp. 124–130). München: Psychologie Verlags Union.

Gump, P.V. (1974). Operating environments in schools of open and traditional design. School Review, 82, 575–593.

Gump, P.V. (1978). School environments. In I. Altman & J.F. Wohlwill (Eds.), Children and the environment. New York: Plenum.

Gump, P.V. (1991). School and Classroom Environments. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology (pp. 691–732). Malabar, FL: Krieger.

Guski, R. (1977). An analysis of spontaneous noise complaints. Environmental Research, 33, 229–236.

Guski, R. (2000). Wahrnehmung. Eine Einführung [Perception. An introduction] (2nd ed.). Stuttgart: Kohlhammer.

Hartmann, W. (1997). Farbe in Kinderräumen. Physiologische, psychologische und biologische Hinweise [Color in spaces for children. Physiological, psychological, and biological considerations]. Deutsche Bauzeitschrift, 5, 81–82.

Hedge, A. (2000). Where are we in understanding the effects of where we are? Ergonomics, 43, 1019–1029.

Hellbrück, J., & Fischer, M. (1999). Umweltpsychologie. Ein Lehrbuch [Environmental Psychology. A textbook]. Göttingen: Hogrefe.

Heller, J.F., Groff, B.D., & Solomon, S.A. (1977). Toward an understanding of crowding: The role of physical interaction. Journal of Personality and Social Psychology, 35, 183–190.

Hillmann, R.B., Brooks, C.I., & O'Brien, J.P. (1991). Differences in self-esteem of college freshmen as a function of classroom seating-row preference. Psychological Record, 41, 315–320. Homburg, A., & Matthies, E. (1998). Umweltpsychologie. Umweltkrise, Gesellschaft und Individuum [Environmental psychology. The crisis of the environment, society and individual]. Weinheim: Juventa.

Hubbard, W. (1980). Complicity and conviction: Steps toward an architecture of convention. Cambridge, MA: MIT Press

Huber, L.G., Kahlert, J., & Klatte, M. (Eds.). (2002). Die akustisch gestaltete Schule. Auf der Suche nach dem guten Ton [The acoustically well-designed school. Searching for the right tone]. Göttingen: Vandenhoeck & Ruprecht.

Kaiser, F.J., & Kaminski, H. (1999). Methodik des Ökonomieunterrichts. Grundlagen eines handlungsorientierten Lernkonzepts mit Beispielen [Methodology of teaching economics. Foundations of an action-oriented learning concept, with examples). Bad Heilbrunn: Klinkhardt.

Klatte, M., Meis, M., Nocke, C., & Schick, A. (2003). Classroom acoustics – acoustical conditions in schools and their impact on students. In M. Cudina (Ed.), Proceedings of the First Congress of Alps Adria Acoustics Association and Third Congress of Slovenian Acoustical Society, Portoroz, Slovenia, September, 1–2 (pp. 9–16). Ljubljana: Slovenian Acoustical Society at the Faculty of Mechanical Engineering.

Klockhaus, R., & Habermann-Morbey, B. (1986). Psychologie des Schulvandalismus [The psychology of vandalism in schools]. Göttingen: Hogrefe.

Knez, I. (1995). Effects of indoor lighting on mood and cognition. Journal of Environmental Psychology, 15, 39–51.

Koch, J.-J. (1986). Behavior Setting und Forschungsmethodik Barkers: Einleitende Orientierung und einige kritische Anmerkungen [Barker's behavior setting and research methodology: Introductory orientation and some critical comments]. In: G. Kaminski (Ed.), Ordnung und Variabilität im Alltagsgeschehen [Order and variation in everyday events] (pp. 33–43). Göttingen: Hogrefe.

Koch, J.-J. (1986). Vandalismus – sozial- und umweltpsychologische Aspekte destruktiven Verhaltens [Vandalism – social and environmental psychology aspects of destructive behavior]. Gruppendynamik, 17, 65–82.

Kohler, N., & Peter, M. (2004). Die Nachhaltigkeit von Schulgebäuden als Beispiele öffentlichen Bauens [Sustainability of school buildings as examples of public buildings]. In I. Beckel (Ed.), Wüstenrot-Stiftung: Schulen in Deutschland: Neubau und Revitalisierung [Wüstenrot Foundation: Schools in Germany: New construction and revitalization]. Stuttgart: Krämer. Kueller, R., & Lindsten, C. (1992). Health and behavior of children in classrooms with and without windows. Journal of Environmental Psychology, 12, 305–317.

Kükelhaus, H., & zur Lippe, R. (1992). Entfaltung der Sinne. Ein "Erfahrungsfeld" zur Bewegung und Besinnung [The unfolding of the senses. An 'experience field' for movement and contemplation]. (1st ed. 1982). Frankfurt am Main: Fischer.

Kükelhaus, H. (1971, 1984). Organismus und Technik. Gegen die Zerstörung der menschlichen Wahrnehmung [Organism and technology. Against the destruction of human perception]. Frankfurt am Main: Fischer.

Küller, R. (1996). Licht, Farbe und menschliches Verhalten [Light, color and human behavior].

In L. Kruse, C.-F. Graumann, & E.-D. Lantermann (Eds.), Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen [Ecological psychology. A handbook of key concepts] (pp. 614–619). München: Psychologie Verlags Union.

Lackney, J.A. (2000). Thirty-three educational design principles for schools and community learning centers. Mississippi State University, MS: Educational Design Institute.

Linneweber, V. (1996). Lernumwelt: Schule [Learning environment school]. In L. Kruse, C.-F.

Graumann, & E.-D. Lantermann (Eds.), Ökologische Psychologie. Ein Handbuch in Schlüsselbegriffen [Ecological psychology. A handbook of key concepts] (pp. 383–388). München: Psychologie Verlags Union.

Linneweber, V., Mummendey, A., Bornewasser M., & Löschper, G. (1984). Classification of situations specific to field and behavior: The context of aggressive interactions in schools. European Journal of Social Psychology, 14, 281–295.

Lorsch, H.G., & Abdou, O.A. (1994). The impact of the building indoor environment on occupant productivity: Part I: Recent studies, measures and costs. ASHRAE Transactions, 100, 741–749.

Lynch, K. (1976). Managing a sense of region. Boston: MIT.

Mahlke, W., & Schwarte, N. (1989, 1997). Raum für Kinder. Ein Arbeitsbuch zur Raumgestaltung in Kindergärten [Space for children. A manual for spatial design of day care centers]. Weinheim: Beltz.

Mahlke, W. (1985a). Raumgliederung im Kindergarten [Spatial organization in day care centers]. In C. Hontschik (Ed.), Raumgestaltung und pädagogisches Konzept im Kindergarten [Spatial design and educational concept in day care centers]. Materialien für die Sozialpädagogische Praxis (MSP) 11 [Materials for social-educational practice, vol. 11] (pp. 33–36). Frankfurt am Main: Eigenverlag des Deutschen Vereins für öffentliche und private Fürsorge.

Mahlke, W. (1985b). Weg von der Raumgestaltung von der Stange. Spielräume für Individuen und nicht für genormte Kinder [No more cookie-cutter space design. Play spaces for individuals, not standardized children]. Theorie und Praxis der Sozialpädagogik, 4, 182–185.

Maron, L.W., Ott, J.N., Nations, R., & Mayron, E.L. (1974). Light, radiation, and academic behaviour. Academic Therapy, 10, 441–448.

Marx, A., Fuhrer, U., & Hartig, T. (1999). Effects of classroom seating arrangements on children's question-asking. Learning Environments Research, 2, 249–263.

Maurer, U., & Maurer, A. (2003). Pädagogische Anforderungen an den Volksschulbau. Literaturrecherche und Kriterienkatalog [Educational requirements for elementary school building. Bibliography and catalogue of criteria.) Zürich: Büro für Schulbauberatung.

McAndrew, F.T. (1993). Environmental Psychology. Pacific Grove, CA: Brooks/Cole.

McKechnie, G.E. (1977). The environment response inventory in application. Environment and Behavior, 9, 255–276.

Meyer, H. (1989). Unterrichtsmethoden II: Praxisband [Instructional methods II: Practice] (2nd ed.). Frankfurt am Main: Cornelsen.

Meyer, H. (1999). Unterrichtsmethoden II: Praxisband. [Instructional methods II: Practice] (11th ed.). Frankfurt am Main: Cornelsen Scriptor. Mommertz, E. (2002). Muss es im Unterricht immer so laut sein? [Does it always have to be so noisy in class?] In L.G. Huber, J. Kahlert, M. Klatte (Eds.), Die akustisch gestaltete Schule – Auf der Suche nach dem guten Ton. [The acoustically well-designed school. Searching for the right tone]. Göttingen: Vandenhoeck & Ruprecht.

Moos, R.F. (1979). Evaluating education environments. San Francisco, CA: Jossey-Bass.

Münch, J. (Ed.) (1998). Hugo Kükelhaus in der Architektur – Bauen für die Sinne [Hugo Kükelhaus in architecture – building for the senses]. Soest: Kettler.

Neumann, K. (1995). Der Einfluss der Gestaltung von Lernumwelten auf die Arbeitseffektivität und das Wohlbefinden unter besonderer Berücksichtigung schulischer Lernbedingungen [The impact of learning environment design on work performance and well-being, with special consideration of learning conditions in schools]. Unpublished examination report, Department of Psychology, University of Koblenz, Germany.

Nickel, H., & Schmidt-Denter, U. (1988). Vom Kleinkind zum Schulkind. Eine entwicklungspsychologische Einführung für Erzieher, Lehrer und Eltern (From infant to school child: An introduction to developmental psychology for teachers, educators, and parents] (3rd rev. ed.). Munich/Basel: Ernst Reinhardt.

Noack, M. (1996). Der Schulraum als Pädagogikum. Zur Relevanz des Lernorts für das Lernen [School space as educational factor: On the importance of the environment for learning]. Weinheim: Deutscher Studien Verlag.

Nolting, H.P. (1997). Lernfall Aggression. Wie sie entsteht – Wie sie zu vermindern ist [Aggression, a case study in learning: How it occurs, and how it can be reduced). Reinbek: Rowohlt. Perings, N. (1999). Schulen aus architekturpsychologischer Sicht [Schools from an architectural psychology viewpoint]. Unpublished examination report, Department of Psychology, University of Koblenz, Germany

Petermann, U., & Menzel, S. (1997). Exkurs: Wie wirken Schulgebäude auf die Schüler. Schulbauten der neunziger Jahre [How do school buildings influence students? School buildings of the 1990s] Baumeister, 4, 61–64.

Pott, G. (1993). Biologesch Bauen a Wunnen [Biological building and living]. Mamer, Luxemburg.: Graphic Press.

Pracht, K. (1994). Licht plus Raumgestaltung [Light plus spatial design]. Heidelberg: C.F. Müller.

Raab R. (1982). Die Waldorfschule baut. Die Architektur der Waldorfschulen 1920–1980. [The Waldorf School builds. The Architecture of Waldorf Schools 1920–1980]. Stuttgart: Freies Geistesleben.

Raywid, M.A. (1999). Current literature on small schools. Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools.

Rebhuhn, M. (1996). Tonangebend [Setting the tone]. AIT Architektur Innenarchitektur Technischer Ausbau, 5.

Rittelmeyer, C. (1988). Gesten der Schulbauarchitektur. Eine Argumentation am Leitfaden der Sinne [Gestures of school architecture. An argumentation guided by the senses]. Bildung und Erziehung, 41, 379–396.

Rittelmeyer, C. (1994). Schulbauten positiv gestalten: Wie Schüler Farben und Formen erleben. [Positive school design: How pupils experience color and form.] Wiesbaden: Bauverlag.

Rittelmeyer, C. (1996). Wie wirken Schulbauten auf Kinder? [How do school buildings affect children?]. Erziehungskunst, 60, 739–735.

Rittelmeyer, C. (1997). Schularchitektur. Wie Schulbauten auf Schüler wirken [School architecture. How school buildings affect students]. Die Ganztagsschule, 37, 29–40.

Rittelmeyer, C. (2000). Schularchitektur aus Schülersicht. Kinderleben [School architecture from the students' point of view. Children's lives]. Zeitschrift für Jenaplan-Pädagogik, 12, 13–16. Rivlin, L.G., & Weinstein, C.S. (1984). Educational issues, school settings, and environmental psychology. Journal of Environmental Psychology, 4, 347–364.

Rohles, F.H. (1973). The revised modal comfort envelope: Description, validation, and application of a new tool for studying thermal comfort. Paper presented at the ASHRAE Spring Conference, Regina, Saskatchewan, Canada.

Rohles, F.H. (1975). Humidity, human factors and the energy shortage. ASHRAE Transactions, 81, 38–40.

Saldern, M. von (1992). Lernen und Klassenklima [Learning and classroom atmosphere]. In G. Nold (Ed.), Lernbedingungen und Lernstrategien [Learning conditions and learning strategies]. Tübingen: Narr.

Schick, A. (1997). Das Konzept der Belästigung in der Lärmforschung [The concept of nuisance in noise research]. Lengerich: Pabst.

Schick, A., Klatte, M., & Meis, M. (1999). Die Lärmbelastung von Lehrern und Schülern – ein Forschungsstandsbericht [Noise nuisance in students and teachers – a report on the current state of research]. Zeitschrift für Lärmbekämpfung, 46, 77–87.

Schillberg, K., & Knieriemen, H. (1996). Naturbaustoff Lehm. Moderne Lehmbautechniken in der Praxis [Natural building material adobe – Modern adobe construction techniques in practice]. Aarau, Switzerland: AT Verlag.

Schmitt, P. (1964). Heimatkalender Kreis Bitburg [Home country calendar Bitburg County) (pp. 207–208). Trier: Paulinus.

Schmittmann, R. (1985). Architektur als Partner für Lehren und Lernen. Eine handlungstheoretisch orientierte Evaluationsstudie am Großraum der Laborschule Bielefeld [Architecture as a partner in teaching and learning. An action-oriented evaluation of the open space in the Bielefeld experimental school]. Frankfurt am Main: Lang.

Schnabel, K. (2001). Psychologie der Lernumwelt [Psychology of the learning environment]. In A. Krapp & B. Weidenmann (Eds.), Pädagogische Psychologie. Ein Lehrbuch [Educational psychology: A textbook] (4th ed.) (pp. 467–511). Weinheim: Beltz/ PVU.

Schröder, R. (1996). Freiräume für Kinder(t)räume! Kinderbeteiligung in der Stadtplanung. [Open spaces for children's (dream) spaces! Children's participation in urban planning]. Weinheim: Beltz.

Schuemer, R. (1998). Dichte und Enge [Density and Crowding]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (p. 57). Darmstadt: Institut Wohnen und Umwelt.

Siegmund, K. (1996). Ab nach draußen. Zur Gestaltung von Außenanlagen. [Let's go outside. On the design of outdoor spaces for children]. Kinderzeit, 2, 25–27.

Smith, P.C., & Connolly, K.J. (1980). The ecology of preschool behaviour. New York: Cambridge University Press.

Sommer, R., & Olsen, H. (1980). The soft classroom. Environment and Behavior, 12, 3–16. Sommer, R. (1972). Design awareness. San Francisco, CA: Rinehart.

Der Spiegel (1994). Der andere Unterricht. Abenteuer Lernen. Wie Schule Spaß macht [The other kind of instruction. The adventure of learning. How school can be fun]. Nr. 35, 47.

Steiner, H. (2000). Gemeinsam gestalten. Arbeitsbuch zur integrativen Kreativitätsförderung [Designing together. A workbook for the integrative development of creativity] (4th ed.). Dortmund: Borgmann.

StoJournal 2/99 [details unknown]

Ströhlein, G. (1998). Beiträge zur Evaluation schulischer Umwelten [Contributions to the evaluation of school environments]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 178–181). Darmstadt: Institut Wohnen und Umwelt.

Sundstrom, E., & Sundstrom, M.G. (1986). Work places. The psychology of the physical environment in offices and factories. Cambridge, MA: Cambridge University Press.

Thomas, K.G. (1987). The effects of high and low social density on on-task behavior and correctness of work sheet completion of sprecial education students. Dissertation Abstracts International, 48, 630–631.

Umwelt Journal (21/1999). Agenda 21 (pp. 24–27, 38–39). Mainz: Falk.

Veitch, R., & Arkkelin, D. (1995). Environmental Psychology. New Jersey: Englewood Cliffs.

Vliet, W., van (1984). Vandalism: An assessment and agenda. In C. Lévy-Leboyer (Ed.), Vandalism: Behaviour and motivations. Amsterdam: Elsevier.

Vorländer, M. (2002). Raumakustik und Sprachverstehen [Acoustics and speech comprehension]. In L.G. Huber, J. Kahlert, M. Klatte (Eds.), Die akustisch gestaltete Schule – Auf der Suche nach dem guten Ton. [The acoustically well-designed school. Searching for the right tone]. Göttingen: Vandenhoeck & Ruprecht.

Walden, R., & Schmitz, I. (1999). KinderRäume. Kindertagesstätten aus architekturpsychologischer Sicht [Places for children – day care centers from the point of view of architectural psychology]. Freiburg im Breisgau: Lambertus.

Walden, R. (1993). Lebendiges Wohnen: Entwicklung psychologischer Leitlinien zur Wohnqualität. Aneignungshandlungen in Wohnumwelten aus der Sicht von Architekten, Bewohnerinnen und Bewohnern [Lively living: Developing psychological guidelines for quality of living. Interior design and living environments from the perspective of architects and inhabitants). Frankfurt am Main: Peter Lang.

Walden, R. (1998). Aneignung [Appropriation]. In F. Dieckmann, A. Flade, R. Schuemer, G.
Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 63–65). Darmstadt: Institut Wohnen und Umwelt.

Walden, R. (1998). BOSTI – Produktivitätssteigerung durch Bürogestaltung [BOSTI – Increasing productivity through office design]. In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 272–281). Darmstadt: Institut Wohnen und Umwelt.

Walden, R. (1998). Wohnzufriedenheit, Wohlbefinden und Wohnqualität [Residential satisfaction, well-being, and residential quality). In F. Dieckmann, A. Flade, R. Schuemer, G. Ströhlein, & R. Walden, Psychologie und gebaute Umwelt [Psychology and the built environment] (pp. 75–114). Darmstadt: Institut Wohnen und Umwelt.

Walden, R. (2002). Schule der Zukunft [The school of the future]. In G. Wenninger (Ed.), Lexikon der Psychologie [Encyclopedia of psychology] (pp. 108–109). Heidelberg: Spektrum.

Walden, R. (2006). Zu den Auswirkungen von Architektur auf Leistung, Wohlbefinden und Umweltkontrolle. Drei Studien zur Schule, Hochschule und zum Bürogebäude "der Zukunft". [On the effects of architecture on performance, well-being, and environmental control. Three studies of schools, universities, and office buildings "of the future"]. Unpublished professiorial dissertation, University Koblenz-Landau, Germany.

Walden, R. (2008). Architekturpsychologie: Schule, Hochschule und Bürogebäude der Zukunft. [Architectural psychology: School, university, and office buildings of the future]. Lengerich: Pabst Science Publishers.

Wasley, P.A., Fine, M., Gladden, M., Holland, N.E., King, S.P., Mosak, E., & Powell, L.C. (2000). Small schools: Great strides. New York: Bank Street College of Education.

Wasserfurth, N. (1996). Licht zum Lernen [Light for Learning]. AIT Architektur Innenarchitektur Technischer Ausbau, 5.

Weachter-Böhm, L. (1996). Lernen in der schönsten Blüte [Learning in full bloom]. Spectrum March 9, 1996. Retrieved from http://db.nextroom.at/tx/534.html on April 4, 2002.

Wenninger, G. (Ed.). (2002). Lexikon der Psychologie [Encyclopedia of psychology]. Heidelberg: Spektrum.

Werner, C.M., Altman, I., & Oxley, D. (1985). Temporal aspects of home. A transactional perspective. In I. Altman & C.M. Werner (Eds.), Home environments. Human behavior and environment, Vol. 8 (pp. 1–32). New York: Plenum.

Winkler, K. (1999). Bewegte Schule – Lebendiges Schulgebäude [School in motion – lively school building]. Retrieved from www.bewegteschule.de/ on September 29, 2005.

Zimbardo, P.G., & Gerrig, R.J. (2004). Psychologie [Psychology]. München: Pearson Studium.

Zwimpfer, M. (1985). Licht, Sehen, Empfinden. Eine elementare Farbenlehre in Bildern [Light, vision, feeling. An elementary color guide in pictures]. Bern: Haupt.

4 Schools Designed with Community Participation

Henry Sanoff

Faith in the collective capacity of people to create possibilities and resolve problems is a centerpiece of a democratic system. Not only do people have the right to participate in making the decisions that will affect them, but also their participation will improve the effectiveness of the decision-making process (Sanoff, 2001). A democratic design process in this context would mean having schools planned by people who will use them, including educators, parents, students, citizens, senior citizens, and members of civic and business organizations. Communities that attempt to involve their citizens in improving education, however, face many obstacles. Some people who want to be involved in schools do not know where to begin. Others feel too overwhelmed or unprepared. Some feel disconnected because they do not have children in school. At the same time, some educators fear that if they expand public involvement, parents and others might make demands of the schools without considering what they can do to help. When community members become a part of a visioning process, they are more willing to work together to set goals, solve problems, and, ultimately, provide their schools with the kind of ongoing support necessary to make them successful (Sanoff, 2001). At the same time, a re-examination of traditional design and planning procedures is required to ensure that participation becomes more than confirmation of a professional's original intentions (Henry, 2000).

4.1 Benefits of Community Participation

A strong facility planning process can reap benefits beyond a pleasant environment. School and community pride as well as faculty morale are raised when the facility planning process involves the right questions, the right stakeholders, and a clear sense of purpose (Copa & Sutton, 2001).

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For decades, educational leaders have discussed the components of a successful educational program, yet they have regarded the physical setting as an institutional backdrop receiving scant attention. Widespread misconceptions reinforce the view that the quality of the school building has no impact on academic performance. Consequently, a gap exists between the educators' view of improving quality and the process of planning schools. Responsive school buildings ought to be an expression of the fact that exploration and discovery are important parts of obtaining knowledge. Current learning styles and teaching methods suggest the need for a new form of learning environment characterized by different activity settings and small-group activities (Lackney, 2000). To obtain and maintain educational quality, however, requires changes in the facility planning process.

Educators are beginning to realize that without the support and engagement of parents and community leaders at the local level, any attempts at improving public schools will ultimately be ineffective. Engagement is when parents and community members collaborate in pursuing their own values and visions for their children's future. Parent engagement is more than volunteering their time for school activities. They initiate action, collaborating with educators to implement ideas for reform. Schools provide the place where people of different backgrounds interact with one another, to listen, to share concerns, to debate and deliberate. Parents and community members can initiate conversations that go beyond the discussion of surface problems and complaints. Through these conversations, people develop the trust and consensus needed for action (Cortes, 1995).

In a survey conducted by Dorman (1987), middle grade parents were asked to identify the important attributes for a school to be considered inviting and friendly for parents and students. One of the common themes among the choices for an inviting school is appearance, which includes maintenance, wall colors, plants, wayfinding clarity as well as the display of student work. Parents were also asked to identify classroom features inviting to their child. The items they identified were temperature control, designated student storage, learning centers, wall colors, and student work on walls. Parents' survey results stressed the use of color and light as those environmental attributes fostering improved student behavior and performance (Dorman, 1987). Other research has shown that parent involvement in schools leads to improved student achievement, reduced absenteeism, decreased delinquency, and reduced dropouts (Howley, 2001). As school buildings and classrooms become more welcoming, parent volunteerism will change and increase from attending periodic Parent Teachers Association (PTA) meetings to active participation.

In education, as in other institutional systems, decisions about school facilities tend to be made by a few people who are not direct building users, often ignoring the direct involvement of teachers and students. Involving a building committee alone does not always solve the problem of gaining school-wide support for the project once the design work is completed. Only a process that allows for face-to-face contact between users and those who influence the decisions can result in a sense of ownership in the process and project.

Personal contact between school leaders, teachers, staff, and students in an organized school planning process can result in considerable savings in time and money, since it provides more relevant information more quickly and efficiently than was possible before. Basically, it requires asking simple questions of who, what, where, how, and when. Like the manager of a professional sports club, planning a participation program requires thinking about goals and objectives, about options and plays, resources and timing, strategies and performances. And like sports, planning for a successful participation program involves a great deal of thought and analysis prior to the first public performance.

Arguments persist that a participatory process requires more of an architect's time and consequently would result in higher costs. Nothing could be further from the truth. Actually, direct participation through intensive workshops requires less time than conventional methods normally used by architects. Involving all participants in a planning workshop is more efficient than relying on information gathered in a piecemeal fashion over long periods of time. The following case studies illustrate the process and methods of community participation.

4.2 Davidson Elementary School as the Center of a Community

4.2.1 Overview

Davidson, North Carolina is a small active community that has taken an interest in its facilities and their appearance. Springing from Davidson's activism, its outmoded elementary school was to be replaced as a result of a bond issue that provided funds for a new 600-student elementary school. In anticipation of their new building, the Davidson teachers had organized, and begun discussions about educational changes they would like to see occur. Recognizing the community spirit and interest in the project, the county school planning administration awarded the contract for the new school to the Adams Group architects, because of their experience in working effectively with community groups. The community involvement process initiated by consultant Henry Sanoff consisted of several workshops oriented towards students, teachers, parents, community members, and school representatives. The intent of these community events was to build consensus through a visioning process aimed at creating a new school building that would complement and support the community's educational objectives.

School facilities are powerful indicators of community values and aspirations. They not only support the academic needs of students they serve, but can also address the social, educational, recreational, and personal needs of the members of the broader community (Kuntz, 1998; Sullivan, 2002).

In Davidson, the new school was also perceived to be the center of the community, particularly since the community working through the PTA expressed a desire to have a full-sized gymnasium, an unusual feature for elementary schools in the region. The gym area would provide a community center for the public and a recreation area for the school. The Town of Davidson would develop the gymnasium in exchange for code-required road improvements provided.

Consequently, the design of this building was driven by the integration of classroom objectives, of experiences planned, and of teaching methods, where team teaching and small group activities were the most influential educational ideas. The central concept of the building was to provide the students with a clear sense of their domain, differentiated from that of the administration. This concept was realized by the creation of a series of art galleries and social centers located at the intersection of each classroom wing, providing opportunities for students and teachers to meet. Enlarged corridors flanking classroom wings with breakout spaces allowed the classrooms to be expanded to accommodate small group activities.

A follow-up evaluation of the school building after it had been occupied for several months revealed that the students had a strong sense of ownership in their school, which plays an important role in terms of learning engagement and ultimately may even their student achievement. This was reinforced by student artwork displayed in the galleries, and the design of the classroom, which encouraged small group activities.

4.2.2 Introduction

The Davidson Elementary School, located in the Charlotte-Mecklenburg area of North Carolina, was designed to accommodate the teachers' and parents' vision of an appropriate environment for 600 children from kindergarten through 6th grade, referred to as a K-6 school. The goal of community involvement was perceived to be instrumental in achieving any changes in the traditional school delivery process, which normally bypasses the teacher's expertise and results in a building produced by a formula.

To begin, an assessment process was developed that included the use of extensive interviews with teachers at each grade level, as well as the use of workshops aimed at identifying educational objectives for different grade levels, and the complementary teaching methods for achieving those objectives. The process developed by design consultant Henry Sanoff began by an introductory meeting with the Davidson Elementary School principal to outline a strategy for parent, teacher, student, and community involvement. The first step consisted of individual interviews with each of the school's thirty teachers to review the educational specifications provided by the Division of School Planning. Educational specifications are typically developed by school districts throughout the United States. The specifications consist of the required number of spaces, and a listing of classroom equipment for each grade level. The obvious limitation of the educational specifications is that they presume a set of educational objectives and a style of teaching. During the interview process, many discrepancies were found between teachers' requirements and those stated in the specifications, such as the location of teachers' workrooms, location of counselor's office, and general requirements for proximity between academic and administrative areas. Teachers preferred several small workrooms to be adjacent to their classroom to allow for parent tutoring and sharing ideas with other teachers, rather than the required work area designated for clusters of classrooms that would be remote from the individual classrooms. The teachers also discussed teaming, and the opportunity for teachers to collaborate more effectively. In respect to spatial concerns, they were fearful that the long noisy corridors in their present school might be repeated.

Community groups were also involved in the design of the school. This included working with local artists, who contributed their time each week to tutor at the school. The artists expressed a desire to have places to exhibit student work as well as art developed by the local community.

4.2.3 Group Interaction Methods

After recording observation, interviewing students and staff, the school community members were ready to consider features of the physical environment through small group discussion sessions that stressed consensus decision making. This small group interaction method described as Relating Objectives for Learning to Education, referred to as ROLE (Sanoff, 1994), allows parents and teachers to discuss, clarify their differences, and seek common understanding. The opening discussion was devoted to establishing commonly agreed-upon

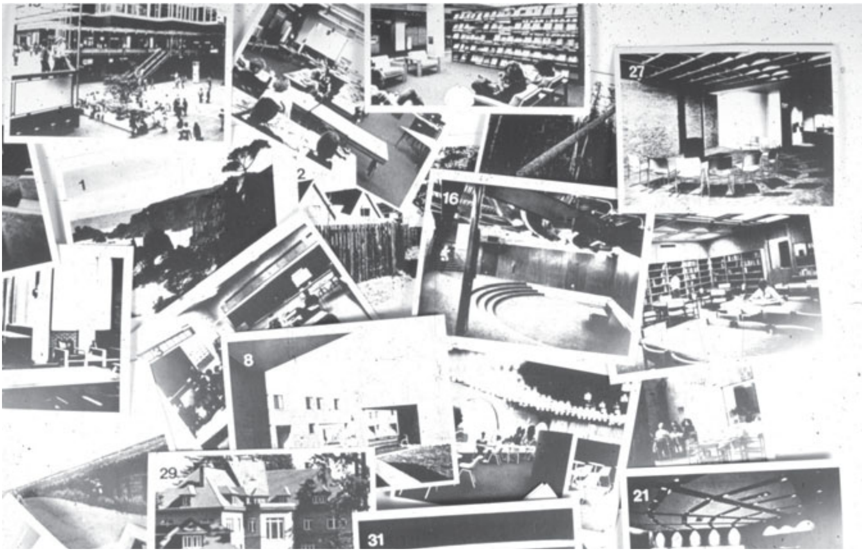

Figure 1. Photographs of learning places

objectives. The teachers were divided into six small groups of five people each, based on their teaching focus. They selected objective statements from a prepared list generated from a review concept derived from a variety of educational sources. Participants were asked to make their decisions based on group consensus to ensure that all voices were heard in the deliberations. In addition to work groups clarifying their ideas and intentions about classroom education, there was a strong support for the school's interaction with the Davidson community. Developing a sense of community emerged as an important focus for the teachers.

The ability to link teaching methods to physical settings was a new experience for the teachers, since their teaching methods were always constrained by the existing classroom. The use of photographs corresponding to the physical settings allowed participants to explore and discuss a wide range of traditional and non-traditional settings used to accommodate such teaching methods as small group discussion, role-playing, and students' self-directed activities. Most importantly, the photographs describe a variety of outdoor settings, suggesting the need for a more integrated indoor-outdoor environment for learning (see Figure 1).

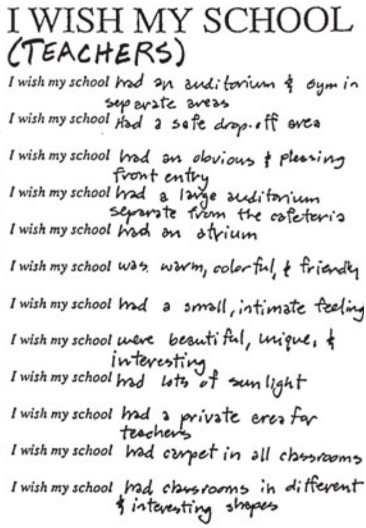

Figure 2. Wish poem

This exercise was instrumental in successive interviews with groups of teachers in using the model of linking objectives to teaching methods. Teachers were able to expand the physical characteristics of the educational specifications to include the objectives for each grade level, the corresponding experiences planned to achieve those objectives, and the teaching methods that might be employed. This concept allowed teachers to envision the classroom as a spatial setting that should accommodate a variety of teaching methods.

The opportunity to use the outdoors for reading, art, eating, and gardening, expanded the teachers' awareness of new learning environments for their school building. This discovery found its way into the building design in the form of outdoor areas adjacent to each classroom, covered porches, and a variety of different courtyard spaces.

Children too, were involved in offering their ideas and perceptions about the new school through their art and through poetry. The art teacher and office staff of the Adams Group met with all the students in the school, for two successive days, through an art exercise where the students were asked to draw a picture of their ideal or dream school. The students made different types of drawings including floor plans, sections, and elevations. Images such as towers, clocks, and clerestory windows all appeared in the students' drawings. One of the interesting

Figure 3. Rating school building images

ideas that emerged from these sessions was that the media center could open to the outdoors, a feature that was included in the building design. The students also stressed the need for daylight in the classrooms and other areas of the building. In addition, teachers, parents, and students were asked to write a wish poem stating their desires for their new school. All participants were asked to complete the phrase, *I wish my school...* shown in Figure 2 (Sanoff, 1994).

The results from each grade and the parents' and teachers' responses were summarized and presented on large sheets of newsprint paper. Many of the wishes stressed the exploration of teaching methods, including team teaching and an environment that supported innovation. There was also an interest in particular physical features, such as an atrium, bright colors, and extensive use of outdoor learning environments. The results of the wish poem, students' drawings, and all subsequent work was on exhibit in the school, as an ongoing record of events, as well as serving to inform those who were not participants of the events that had occurred.

The final workshop consisted of a building image study, and site planning exercise, in which 35 teachers, parents, and school-planning officials worked collectively. The building-image study began with a slide show depicting ten different school buildings, each representing different regional characteristics and design

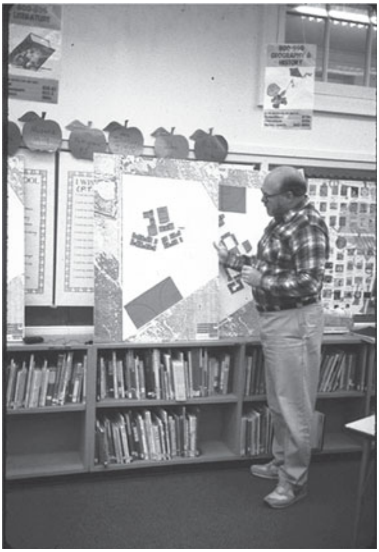

Figure 4. Parent-teacher workgroups presenting site plans

features. The participants rated each building, and an overall priority list was established. The purpose of this exercise was to increase the participants' level of awareness as to the possible variations in the visual character of school buildings. In effect, the exercise intended to expand their vision of building images beyond their everyday experiences with school buildings (see Figure 3).

The final event was the site-planning exercise where participants were given a scaled drawing of the new site, located several blocks from their present school, and scaled building components representing all the spaces in their school building. All building components had labels fastened to pieces of Styrofoam. Each of the six groups was asked to develop a building plan located on the site, considering bus drop-off, parking, soccer field, cluster patterns of classrooms, outdoor space, and appropriate orientation and daylight. At the completion of the two-hour exercise, representatives from each team presented their solutions for discussion and debate. The participants then displayed all of the solutions for review (see Figure 4).

Similarities between solutions occurred in the deliberate use of open space and courtyards, and the clustering of kindergarten, 1st and 2nd grade classrooms, separated from the 3rd, 4th, and 5fth grade classrooms. Team teaching appeared to guide many of these design decisions. While group members had some dissat-

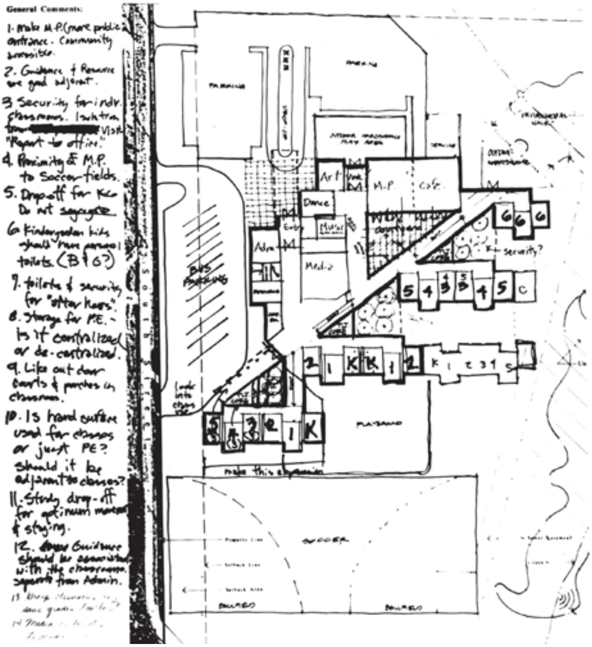

Figure 5. Teachers' written comments about design proposal

isfaction with their solutions, they all agreed that they had a better understanding of the complexity of issues requiring simultaneous consideration. They readily admitted being more sensitive to the role of the architect, and were willing to leave the resolution of the problems to the architect.

4.2.4 Design Development

The design team met after the workshop to synthesize the workshop results and to arrive at a solution that would satisfy the requirements developed through the interviews and workshops. One scheme was developed and proposed to the school community by posting large-scale drawings in key locations in the present school building. Teachers were requested to write their comments about the proposal's positive and negative features directly on the drawings.

After several days of allowing the teachers to discuss the proposal and to comment, the drawings were retrieved and reviewed by the design team, only to find the comments very minor in detail (see Figure 5). All the teachers seemed to identify elements of their design ideas in the architect's submission. At this

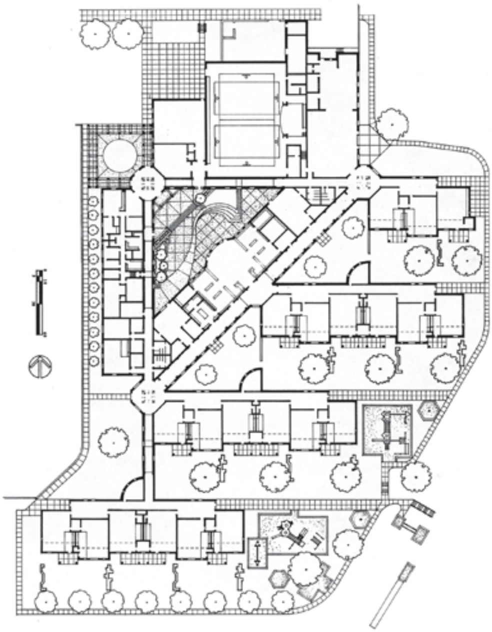

Figure 6. Plan of school building

point, and until preliminary drawings were completed, the involvement of teachers was limited to personal interviews clarifying details of classroom design.

The building design contained features that were not typical of traditional schools in the area. Such features were, namely, clustered classrooms to facilitate team teaching and non-graded classes corresponding to the curriculum changes occurring with all Charlotte-Mecklenburg schools, single-loaded corridors with classrooms oriented toward the south, and outdoor play areas for each classroom. This arrangement allowed each classroom to have a relatively private outdoor area (see Figure 6).

A plan review conducted by the North Carolina State Department of Public Instruction raised questions about these and other unusual design features, some of which might increase the operating cost of the building. The Davidson school proposal was very different from any other school plan that they reviewed. Since the original intention of this project was to create a building that satisfied the needs of the teaching staff and administration, as well as the historic concerns of the community, it was agreed to allow the community to make the final decision (see Figure 7). A review with the teachers and principal indicated strong support for the cluster arrangement and the opportunity for greater teacher collaboration. Citizens of Davidson were equally supportive of the design solution, particularly since they were providing the funds for a gymnasium to be used by the community as well. Adams architects commented: "If the teachers and administrators had not been involved in the process, it is pretty clear that the State and County plan reviewers would have been very forceful to have the architects change the plan. It was only through the intervention of the teachers and administrators, and the arguments they made for the curriculum, that allowed the slightly higher cost for heating to be overpowered by the gains of the curriculum."

4.2.5 Post-Occupancy Evaluation

Construction was completed on the Davidson Elementary School in January 1994, at which time students and teachers took occupancy. A research team from North Carolina State University (Hyder & Rice, 1994) conducted a post-occupancy evaluation (POE) using a walkthrough evaluation, systematic observations of classroom and public space behavior, and a student-teacher questionnaire. Post-occupancy evaluation is an assessment of environmental performance relative to defined objectives and requirements, with the aim of providing satisfactory environments for their occupants (Preiser, 1988). The thrust of the POE was to validate initial design assumptions about student ownership in the building and its positive effects on their learning. Ownership was operationally linked to student's ability to personalize their environment. Additionally, learning through social interaction with peers and teachers was a factor that influenced the design of areas inside as well as outside the classroom.

Observations were conducted of children's behavior in eight different classrooms. The results indicated that classrooms of younger children exhibited versatility in seating arrangements, well-defined activity areas within the classroom, and continuous use of the adjacent outdoor area. Classrooms of the older children were arranged in such a way that the focus was on the teacher. Interestingly, all classrooms were designed to discourage rows of desks facing the teacher.

Thirty-six teachers and 60 students from 4th to 6th grade were surveyed. Both questionnaires focused on the classroom and adjacent areas, and how they contributed to the learning process. Distinctions were made between the influences of the teacher and the classroom environment. It was apparent from the results that the teacher's attitude towards education directly influenced the ability for students to personalize their environment. Classroom territory was extended into the hall by the exhibition of student artwork and projects. How-

2M *MECKLENBURG NEIGHBORS Sunday, January 9, 1994 ★★★★

Davidson school designed with kids in mind

New

From preceding page

White rejoiced in the spaciousness of her new classroom, far larger than the trailer she'd used since August at the old Davidson Elementary that was built after World War II a few blocks up South Street.

"I'm so thankful to have this nice tile floor, the sink and counters, the patio," she said, pointing across the room toward a door leading to a covered patio for each classroom. "Frankly, we didn't have these kind of things in the old school."

Many teachers moved into their new classrooms over the holidays, an example of personal commitment their principal praised.

"Their dedication over the holidays allowed us to open so smoothly," she said.

Consistent with its child-oriented design, many things show up that are practical, downright good sense.

Classrooms are carpeted, but there also are areas where the floor is easily washed tile. These are areas where kindergartners might spill sand or paint, or older students do science projects that use water and other spillable materials.

Each classroom also has a door to the outdoors, with a covered patio ready for nature study, gardening projects, water and sand tables and storytelling in fine weather.

There is a computer area in every classroom that is totally networked. A student can go to a computer in any classroom and call up any program in the school. Computer modems allow students to work on computerized projects prepared, for example, by the National Geographic Society.

And the classroom wings are arranged so rooms are along just one side of the hall, avoiding noise and the distraction from classes across the hall. This was an idea from the Davidson faculty.

And Baucom notes that large portions of the hall in each wing are wide enough to allow groups of students to gather just outside their classrooms for special study or projects.

And groups of classrooms — kindergarten, first and second grades, for example — are usually clustered on the same hallway.

That serves an educational objective for youngsters, the principal says.

"One of our philosophies in Charlotte-Mecklenburg is to move students along the curriculum regardless of their grade level."

For example, when a child has mastered second-grade mathematics, he or she will be able to move easily to third-grade math lessons being taught next door or just down the hall.

The needs of Davidson's staff and parents were also taken into account, Baucom notes. The final design was the result of much discussion among the Davidson faculty, administration, parents, students, town leaders and the architects — The Adams Group of Charlotte; and consulting architect Henry Sanoff of Raleigh.

Graham Adams, of The Adams Group, said the discussions were both helpful and productive.

"Any time you have people involved in education working with you, you have a better plan," he said. "The key is that people working there every day know how to make a better school."

The architects also worked with the Town of Davidson's appearance commission to create a design consistent with the town's overall, historic look.

The town also wanted a a full-size gymnasium. So it agreed to invest about $250,000 in street, curb and gutter work at the school in exchange for a community gymnasium that can seat about 800 people.

Baucom says Davidson Elementary is blessed with a large cadre of parent volunteers who tutor and support the school in many ways.

"We have numerous volunteers every day," she said. "They needed a place to work and to meet."

At the old Davidson Elementary, the parents had a desk in the hall. In the new one, they have three parent centers featuring tutoring carrels, sofas and chairs. Teachers, too, have something new and different. Between each two classrooms is an office with telephones where two teachers can place their desks.

At the heart of the child-centered Davidson school is a belief in flexible use of space. The central courtyard, which opens off the art, computer and media centers as well as the main entryway, may at times be the site of storytelling, drama, receptions or small assemblies.

"Everything in this school will be flexible, so that we can adapt to students' learning styles and that classrooms can adapt to different teaching strategies," the principal says.

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Staff writer Neil Mara contributed to this article.

Vision becomes reality: More than two years ago, the Davidson students were given a voice — actually a pencil — in designing their new school. They drew pictures and floor plans — even wrote poems about what they'd like to see in the new school. Sheena Goldstein's painting is remarkably like the finished design, particularly such details as the central cupola and roof line.

TOM FRANKLIN/Staff

Relaxing fun: Fifth-graders Danielle Broome (from left), Stacia Mercer, Reynolds Anderson, Christina Sherrill and Tamara Henrickson enjoy the new beanbag chairs at Davidson Elementary.

Davidson Elementary School

Here are some features of the new Davidson Elementary School on South Street:

Cost: $4,769,901, typical for modern elementary schools. The money came from the 1991 school bond issue.

Students: 510.

Space: 21 classrooms plus a community gymnasium with stage, cafeteria with space for outdoor dining, media center, gallery, courtyards and playing fields. The school grounds encompass 20 acres.

Principal: Angela Baucom.

Architect: The Adams Group of Charlotte. Consulting architect Henry Sanoff of Raleigh.

Builder: Edison Foard Inc. of Charlotte.

Figure 7. The project makes newspaper headline

ever, while teachers generally agreed to the importance of providing a variety of workspaces within the classroom to allow for spontaneity of group activity, the students felt that teachers exerted considerable control over their use of the classroom environment. Consequently, personal space was perceived by the students to be limited to their desk. Individual personalization occurred through the use of nametags and desk identification.
Almost all teachers encouraged personalization of the classroom and surrounding areas. To achieve this, bulletin boards within and immediately adjacent to the classroom were used to acknowledge student achievement, to promote group identity, and to define class territoriality. Teachers were enthusiastic about the way in which the classrooms were designed to facilitate group activities, and with the overall design of the building. Students, too, had very favorable comments about their new environment.

Although the students and teachers had occupied this building for only four months prior to conducting the evaluation, it was apparent that the teaching staff needed more time to settle into the building. This additional time would allow teachers to more effectively manipulate the total learning environment to accommodate their educational objectives. Consequently, a walkthrough was conducted two years after occupancy. From this walking tour it was readily apparent that teachers and students had assumed ownership in the building. Creating soft spaces carved out of the wide circulation spine extended classrooms. Teachers, with the help of students, organized special activity nodes, some of which were furnished with soft, comfortable seating (see Appendix). The enlarged hallway areas were used by lower grades to set up activity zones for small groups and individuals, while the upper grades utilized the area as predominantly tutorial or conference space.

Classrooms had also expanded outdoors to include gardens and a variety of student projects. Bold colors accented special places where community artists contributed their paintings and sculpture to the school (see Appendix). The school had become the center of the community.

4.2.6 Sense of Ownership

To determine if the design of the school environment can afford opportunities for enhancing students' sense of ownership in learning, a comparison between two schools was conducted (Killeen, 2003). Both schools are located in the same school district. Davidson school was designed as a community center with gallery areas and wide corridors for the purpose of displaying art. In this school, permanent student artworks are ceramic tile displays that were installed on the block walls of the schools' hallways. The other elementary school was selected to match the same demographic profile and geographic location and constructed at the same time with the same design guidelines as the Davidson school, but without the participation of students, teachers and the local community.

Since teaching philosophy may be a factor influencing students' sense of ownership, teacher involvement and control in the classroom was measured through the use of the classroom environment scale (Moos, 1979). An example question of involvement is, "very few students take part in class discussions or activities." An example question of teacher control is, "there are very few rules to follow." Comparing sense of ownership between the two schools indicated a significant effect of the design of the learning environment on students' sense of ownership. After this initial analysis, a further comparison was made between sense of ownership and degree of student work on display. Davidson students, who have more work on display, scored higher on the scale of sense of ownership. A school that has incorporated permanent student artworks into the interior spaces of the school building was shown to increase their sense of ownership in the learning process. Sense of ownership plays an important role in terms of learning engagement and ultimately may even affect student achievement (Voltz & Damiano-Lantz, 1993).

4.2.7 Conclusion

The intent of this evaluation was to narrow the gap between what we know about the education of young people, and what we observe happening in everyday school environments. Observations of school buildings and classroom behavior provided insight into space use that often denies the existence of variations in types and styles of learning. Also, buildings produced without the involvement of those who will use the building can further exacerbate the rising alienation found in many schools. It is evident that a sense of ownership achieved through participation has far-reaching positive effects, especially when the viability of traditional school building standards and processes is questioned.

The Davidson School won an Honor Award and a Post Occupancy Evaluation Award from the School Construction News and Design Share Awards Program in 2000. This case study is an expansion of the version that appeared in Community Participation Methods in Design and Planning, by Henry Sanoff, published by John Wiley and Sons, 2000.

4.3 A Community School Designed for Accessibility

4.3.1 Overview

Located in an ethnically diverse area of Berkeley, California, the Rosa Parks Elementary School (formerly the Columbus School) was declared seismically unsafe following the 1989 Loma Prieta earthquake. The Columbus School has been the heart of the West Berkeley community for well over half a century. The decision to close the school after the 1989 earthquake was heartbreaking and an opportunity to revitalize the aging center of the community. The Berkeley Unified School District supported the community's vision of creating a model community-oriented urban school. Working closely with the school district, teachers and the community, the architects planned and designed a new K-5 school that provides a preschool, before and after-school childcare programs, a learning resource center for students and parents, and a science center, as well as space for family programs, counseling, and healthcare services.

The participatory process, which included parents, teachers, children, and community members, began well before the school design started. Berkeley citizens initiated and passed a bond measure to rebuild the earthquake-damaged school and organized the Measure a Columbus School Site Committee, a racially and economically diverse group made up of senior citizens, young parents, teachers and staff, and neighbors. Central to the vision established by the site committee was that of a community school designed not only to educate but also to strengthen families and build community. The Berkeley Unified School District identified with this vision and commissioned Ratcliff Architects because of their willingness to work intensively with the community to remodel the earthquake-damaged Columbus School. However, after a structural review it was deemed more cost effective to build a new school. With the principles of universal design in mind, the design approach to the new school aimed at creating an environment that would be usable by all people to the greatest extent possible. The principles were applied to evaluate this building as well as guide the design process about the characteristics of more usable environments. The principles include that a design solution should be useful to people with diverse abilities; should accommodate a wide range of individual preferences and abilities; should be easily understood; should communicate effectively regardless of user's sensory abilities; should minimize hazard; should be efficient and comfortable; and should be appropriate for users' body size, posture and mobility.

According to the teachers, the school building achieved the design goal of being inclusive in considering the needs of a diverse student and teacher population.

4.3.2 Community Design Process

The site committee working with the architects organized a series of five bilingual workshops to discuss school needs. Neighbors, parents, grandparents, teachers, children, police, social and health workers came together with district personnel to participate in the design process. The initial workshop consisted of five teams of twelve people each who walked the school site noting changes needed on a site plan, where the location of the new school entrance was unanimously agreed upon. Subsequent workshops had participants place buildings on a scaled site plan, discuss classroom groupings, and construct scale models of an ideal classroom (see Appendix). The major components agreed upon in the workshops were indoor and outdoor teaching spaces, clustered classrooms, and a school that should reflect the residential character of the neighborhood.

A site model submitted and approved by the site committee and the school board included all the major features identified in the workshops such as classrooms sharing a patio and opening onto a courtyard shared by several other classrooms. Each courtyard in the design solution opened to a playground adjacent to an entry courtyard that served as the front door to the community. Classrooms are designed as houselike structures, each of which shares a patio and office resource space with the next. The classrooms are grouped in four clusters around courtyards, which provide a child friendly scale and protected play areas for younger children (see Appendix).

4.3.3 Inclusive Design Assessment

The vision of a community-centered school that features preschool, before- and after-school activities, a family resource center, and supervised recreation programs serves people of all ages and abilities. Although education practice under law requires public schools to open their doors to children with disabilities, school buildings are often unable to accommodate those with learning disabilities or those who are mentally, visually or hearing impaired. Since the Rosa Parks School exemplifies a broad base of community participation that included specialists from social and health services, the architects and school principal agreed to a study that measures how well the building satisfies the special needs of its users. These particular measures of satisfaction, referred to as universal or inclusive design, ask from the outset how to make the design work beautifully and seamlessly for as many people as possible. If a design works better for people with disabilities, it works better for everyone.

To assess the effectiveness of school buildings in meeting the needs of its diverse users, a survey tool was developed based on the principles of inclusive design (Story, Mueller, & Mace, 1998). The principles suggest that a design solution should:

- Be useful to people with diverse abilities
- Accommodate a wide range of individual preferences and abilities
- Be easily understood
- Communicate effectively regardless of users' sensory abilities
- Minimize hazard
- Be efficient and comfortable
- Be appropriate for users' body size, posture, and mobility.

The inclusive school building assessment checklist consists of nine factors with a series of statements that teachers rated on a scale from very unsatisfactory (VU) to very satisfactory (VS). The factors were:

- Building setting – The ease with which people move around in the environment. – Information legibility – Signs, shapes and materials influence how well people understand their environment.
- Comfort – The environmental conditions affect people's comfort.
- Safety – The building features that ensure the safety needs of people.
- Wayfinding – The ability for building occupants and visitors to recognize routes, traffic patterns or passageways in and around the building.
- Communication – The environment communicates information to people regardless of their abilities.
- Social engagement – The environment accommodates diverse human needs and allows opportunities for active participation and inclusion.
- Versatility – Furnishings and equipment aid in achieving an inclusive learning environment.
- Imageability – Overall features of the environment can convey the effectiveness of inclusive design.

Sixteen teachers and staff members, including the past and present principal, participated in rating 75 items contained in the school building checklist.

Generally, the teachers were satisfied that their school environment accommodated a variety of disabilities, however, there were some differences of opinion. Although walk-ways to and around the buildings were satisfactory for people with different disabilities, some teachers viewed separation between bus drop-off, car circulation, and entrance visibility from drop-off areas as unsatisfactory (see Appendix). They also commented that there was a lack of sheltered places to sit at bus drop-off areas for people with different physical abilities, however, adequate seating was provided at those locations.

Most teachers were satisfied with classroom comfort except for those few who had direct contact with students experiencing breathing difficulty in carpeted areas, symptoms of nausea or watery eyes after leaving a specific area or building, and new smells particularly after a space has been cleaned. For some teachers, year-round temperature control was unsatisfactory since several classrooms were reported as being uncomfortable. This response was surprising since each classroom was designed to include individual heating controls, and operable windows for cross-ventilation and controlled daylight.

Several teachers noted that the location of their office was not easily accessible to students. One of the design features was to position a shared teachers' office between classrooms, which did not afford direct access to their office except through a classroom. Most teachers, however, found their office arrangement beneficial for sharing ideas with their colleagues. For students with visual impairments, teachers commented that circulation routes were not marked or clearly understood, that there were some visual distractions in learning spaces, and there was an insufficient variety of communication methods.

The school environment was successful in accommodating students' ability for active participation and inclusion. Teachers agreed that there were places where students could meet informally with friends, and learning spaces functioned well for small group meetings and places that needed to be quiet. Instructional spaces allowed simultaneous activities to take place and still serve the needs of hearing-impaired students. According to several teachers, however, exhibition space to display student work was inadequate and furnishings and equipment in recreation areas were not equipped for the use of all students. The majority of the teachers felt that learning spaces did not separate students with disabilities from their peers, and that the school environment was easily accessible to all people.

Overall, the teachers believed that the features of the school clearly conveyed the effectiveness of inclusive design. They were able to recognize interior functions, such as classrooms and administration areas from the outside of the building. They agreed that the school grounds and building was esthetically pleasing, and as a result made daily activities more pleasant to accomplish, and helped students feel a sense of belonging.

4.3.4 Conclusion

The Rosa Parks Elementary School was the result of a long inclusive community planning process, which not only fostered the design of a human place, but also had an impact on the community. Children and families can take advantage of various community services at the school, including health and counseling services, and after-school activities. Community use of the facilities includes a multi-purpose room for public meetings, rehearsals of the Berkeley Symphony Orchestra, and celebrations and performances. The community's collaboration with the architects resulted in a place whose design fosters community connectedness and social goals. The Rosa Parks School won the Places/EDRA design award for demonstrating the connections between good participation, good design, and good consequences (Bressi, 2000).

4.4 Summary

Inadequate school facility planning carries fiscal, human, and academic costs. Whether a school building is old or new, problems in design can take a devastating toll.

Schools that lack ventilation can make students drowsy or tempers flare (Wargocki, Wyon, Matysiak, & Irgens, 2005). Open classrooms with noise and visual distractions can distract attention from the best-prepared lesson plans (Gump, 1987). Congested hallways can needlessly fuel student and staff hostilities. Drab interiors, poor lighting, and the lack of pleasant social gathering spots make school less than inviting as a place to work and learn (Heschong, 1999). On the other hand, a strong facility planning process can reap benefits beyond a pleasant environment. School and community pride as well as faculty morale are raised when the facility planning process involves the right questions, the right stakeholders, and a clear sense of purpose. To more fully integrate with the community, schools can extend the learning environment to become centers of community, and consequently become more intensively used.

Another factor prevalent in both case studies is a return to smaller, neighborhood schools, since they produce better academic results (Cotton, 2001), and the ability to interact on a personal basis with the teacher (Stevenson, 2006). Some researchers argue that small schools are more cost-efficient when considering dropout/graduation rates (Howley, 2001). Barker and Gump (1964) were among the first to demonstrate diminishing returns to increasing school size.

While they recognized that big schools might be able to provide some services that small schools cannot, ultimately they concluded that it might be easier to bring specialized services to small schools than to raise the level of participation in large schools.

Such physical design issues as classroom shape that encourages small group activities and a sense of ownership emerged as a result of the collaboration between the architect, teachers, and students. Conventional classroom shapes limit what can occur within the layout, since they do not provide defined areas where different activities might occur simultaneously without any disruptions. The “L” shaped classroom in the Davidson school, on the other hand, allows for grouping different activities, allows for ease of teacher movement, and encourages teacher/student interaction.

Participation in school and community issues places serious demands and responsibilities upon participants. Although people voluntarily organize to participate in community projects, the technical complexity of such projects usually requires professional assistance. In addition to the need to address technical complexity, sound design and planning principles must be incorporated in the school design process. Without guidance, community groups may respond only to situations of crisis and may not achieve the goals that originally united them. The management of participatory efforts is important.

Tomorrow’s school facilities should be designed to serve not only educational but a variety of community needs (Bingler, Quinn, & Sullivan, 2003), such as:

- Help a community’s recreational and wellness needs.
- Be accessible to people of all ages.
- Encourage more active parental involvement in school activities.
- Contain accessible shared public spaces.

The key to providing school facilities that meet current and future needs in a given community is to constantly scan the environment, communicate regularly with educators, the community, businesses and policy makers, and stay aware of current educational, design, and environmental issues. Otherwise, reliance on “It’s always worked in the past,” or on “That’s how it has always been done” may well result in the waste of limited resources, dissatisfaction in the community, and reduced opportunities to optimize instruction and educational outcomes. A basic element of effective planning for the 21st century must be “thinking beyond today.” Specific questions must be asked on an ongoing basis: “What is emerging in educational practice that may affect school design tomorrow? What is happening with the demographic composition of my community that may change how education must be delivered? Does quality research exist that indicates education can be delivered more effectively?" Only if such questions are addressed can we hope that the school facilities of tomorrow will adequately support the educational programs of the day.

References

Barker, R.G., & Gump, P.V. (1964). Big school, small school: High school size and student behavior. Stanford, CA: Stanford University Press.

Bingler, S., Quinn, L., & Sullivan, K. (2003). Schools as centers of community. Washington, DC: National Clearinghouse for Educational Facilities.

Bressi, T. (2000). Rosa Parks Elementary School. Places, 14(1).

Copa, G., & Sutton, S. (2001). New visions. Northwest Education, 6(4), 10–13.

Cortes, E., Jr. (1995). Engaging the community in education reform. Community Education Journal, 23(1–2), 26–32.

Cotton, K. (2001). New small learning communities: Findings from recent literature. Portland, OR: Northwest Regional Educational Laboratory.

Dorman, G. (1987). Improving middle-grade schools: A framework for action. Chapel Hill, NC: Center for Early Adolescence, University of North Carolina.

Gump, P.V. (1987). School and classroom environments. In D. Stokols & I. Altman (Eds.), Handbook of environmental psychology, Vol. I (pp. 691–732). New York: Wiley.

Henry, C. (2000). Planning without anxiety. School Planning and Management, 39(10), 28–30.

Heschong Mahone Group (1999). Daylighting in schools: An investigation into the relationship between daylighting and human performance. San Francisco, CA: Pacific Gas and Electric Company.

Howley, C. (2001). Research on smaller schools: What education leaders need to know to make better decisions. ERS Informed Educator. Arlington, VA: Educational Research Service.

Hyder, J., & Rice, J. (1994). Post-occupancy evaluation of the Davidson Elementary School. Raleigh, NC: College of Design, North Carolina State University.

Killeen, J.P. (2003). The inclusion of permanent student artwork in public schools and its relation to sense of ownership in an elementary school. Environment and Behavior, 35(2), 250–263.

Kuntz, W.S. (1998). Cultural impact of participants in the design of community schools. Baltimore, MD: Johns Hopkins University.

Lackney, J.A. (2000). Thirty-three educational design principles for schools and community learning centers. Washington, DC: National Clearinghouse for Educational Facilities.

Moos, R. (1979). Evaluating educational environments. San Francisco: Jossey-Bass.

Preiser, W.F.E., Rabinowitz, H.Z., & White, E.T. (1988). Post-occupancy evaluation. New York: Van Nostrand Reinhold.

Sanoff, H. (1994). School design. New York: Wiley.

Sanoff, H. (1996). Designing a responsive school. The School Administrator, 53(6), 18–22.

Sanoff, H. (2000). Community participation methods in design and planning. New York: Wiley. Sanoff, H. (2001). A visioning process for designing responsive schools. Washington, DC: National Clearinghouse for Educational Facilities.

Stevenson, K.R. (2006). Educational facilities within the context of a changing 21st century America. Washington, DC: National Clearinghouse for Educational Facilities.

Story, M., Mueller, J., & Mace, R. (1998). The universal design file: Designing for people of all ages and abilities. Raleigh, NC: The Center for Universal Design, North Carolina State University.

Sullivan, K. (2002). Catching the age wave: Building schools with senior citizens in mind. Washington, DC: National Clearinghouse for Educational Facilities.

Voltz, D.L., & Daminao-Lantz, M. (1993). Developing ownership in learning. Teaching Exceptional Children, 25(4), 18–22.

Wargocki, P., Wyon, D.P., Matysiak, B., & Irgens, S. (2005). The effects of classroom air temperature and outdoor supply rate on the performance of schoolwork by children. Proceedings of Indoor Air 2005. Beijing, China.

5 Trends in the Design and Planning of Schools from the Viewpoint of Information Technology and Communication

Kaname Yanagisawa

5.1 The Current State of Learning and Information Technology in Schools

There is a growing spirit of innovation in school design and planning worldwide. Information technology introduced into schools promotes individual learning and a closer link with the community. More schools tend to introduce new learning methods such as interdisciplinary, hands-on, and self-learning. The establishment of networking between school and community also depends on information technology (IT). Satellite schools, home schooling, and off-campus learning at various sites are increasing in popularity. According to my current research, these trends are seen not only in Japan but also in the USA and several European countries (Yanagisawa, 2006a). From the viewpoint of IT application and individual learning, there are necessary conditions for IT schools. To additionally enhance these schools as innovative, the following elements should be considered:

1. Spaces for self-learning with IT facilities in all parts of the school;
2. Accessible learning resource center as a core of the school;
3. School furniture and workstations designed for information technology;
4. Development of educational software and curriculum;
5. Promotion of human resources to support information technology, i.e., on-campus/off-campus training for teachers, staff, librarians, and volunteers.

In Japan, the national government introduced a new action plan that expressed the goal of networking every public school from elementary to high school by 2005, with one computer per two students at the elementary level and one com-

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puter for every student at the junior and high school level. By 2006, most of the schools had followed this plan, however, some schools are still lagging behind. The national government also recommended introducing a “new generation learning space” in every public school for promoting individual learning.

In the age of information technology, communication and place are becoming important. In the USA, every school, institute, firm, and home will be networked by the early 21st century. In the UK, every school was networked by 1998. Remote internet-based learning systems such as virtual schools and e-learning are becoming more popular in the USA, Canada, Australia, and some European countries. In light of these global advances, more emphasis should be placed on face-to-face communication than on virtual communication by means of IT. In the future, schools might change from places for learning to places for communication and social interaction. Therefore, schools should have various social spaces and spaces for visual contact: Common spaces, alcoves, lofts, sunny decks, atrium, and community streets are examples. Information technology in schools promotes student-oriented learning and a way of life. It leads to demands for communication between students and teachers in school, and also between the school and the community. Most schools now open their facilities to the public. If the school becomes an attractive place for communication and social interaction, people from the community may also enjoy it and feel comfortable when they use it. (Yanagisawa, 2006a).

5.2 Cases of Innovative Schools Worldwide

5.2.1 Gunma International Academy

Ohta, Gunma, Japan, 2005; grades 1–9, 970 pupils Architects: CAt + CAn, Planning Advisor: Jun Ueno and Kaname Yanagisawa

Gunma International Academy in Ohta city introduces “immersion education,” which uses English native teachers and Japanese teachers to teach subjects in English as a team. Ohta city is authorized as a special educational ward by the national government as a way to establish this unique school. Students from 6 to 15 years old study every subject in English, except Japanese language classes and social science classes. The school building is specially designed to correspond to this unique educational system by grouping every three grades in “neighborhoods.” Every “neighborhood” has three units called “houses” with 100 pupils in the same grade. Each “house” has a closed classroom, an open classroom, an art and science area, three home bases, a quiet room, and a teacher station. The

Figure 1. Floor plan of Gunma International Academy, Ohta, Gunma, Japan, 2005 (CAt + CAn, Architects).

school is a one-story wooden building with many courtyards used for both learning and playing. Besides English-based learning and team teaching, the school also focuses on individual and diversified learning using IT. There are many computers, not only in the media center, but also in each house's common spaces and quiet rooms. There are also various social places inside and outside of the school. (See Figure 1 and Appendix.)

Figure 2. Floor plan of Akemi Minami Elementary School and Akemi Middle School, Urayasu, Chiba, Japan, 2005 (INA, Architects).

5.2.2 Akemi Minami Elementary School and Akemi Middle School

Urayasu, Chiba, Japan, 2005;
grades 1–9, 960 + 600 pupils
Architects: INA,
Planning Advisor: Kaname Yanagisawa

This school was built in a newly developed residential area in the Urayasu bay area. The school is composed of an elementary school, a middle school, and shared facilities. The elementary school and the middle school areas are connected to each other by a spacious hallway called a "community street" for social interaction between elementary and middle school students. The shared facilities area including a gym, library, multi-purpose space, music room, and labs is located in the center for easy access from both the elementary and middle schools. This area is assumed to be used by the community as well. Regular classrooms in each grade are grouped in cluster units. There are various learning spaces besides regular classrooms in each unit, such as a science and art room, student lounge, teacher's workstation, common work area, reading area, quiet room called "den," wet corner, and computer center. There is a wide wooden deck in front of classrooms for outdoor activities. These spaces are designed to encourage individual learning and social interaction. (See Figure 2 and Appendix.)

5.2.3 The School of Environmental Studies

Apple Valley, MN, USA, 1995; grades 11–12, 400 pupils
Architects: Bruce Jilk, H.G.A. Architects

This school was built in the Minneapolis-St. Paul suburb with the goal of integrating traditional disciplines within the context of studying the environment. This school is also known as the "zoo school" because of its active partnership with the Minnesota Zoo. The school embraces project-based learning with an environmental theme. Students are grouped into four houses of 110 pupils with three or four teachers each, who are teamed up. Each house, on the second floor of the building, has a science classroom, a shared teachers' office, a common space, and student workstations. The workstations are composed of 10 pods with 10 pupils each, and are intended as a place for individual work and personal activities. The common space is used for team learning and presentations. There is a community area on the first floor which includes a forum, library/ media center, and several laboratories. The forum, with large windows offering a view to outside nature, is used as a cafeteria, auditorium, and display center. The school has a large quantity of IT equipment such as computers and video and audio equipment in the houses, labs, and hall for promoting students' individual learning (see New Design for Learning, 1999). (See Appendix.)

5.2.4 Crosswinds Arts and Science Middle School

Woodbury, MN, USA, 2001; grades 6–8, 600 pupils
Architects: Cuningham Architects

This school operates as a year-round school for 600 students from eleven (originally six) districts with an emphasis on arts and science. Educators, parents, and community members collaborated to create a vision for the school such as hands-on project-based learning and development of presentation and performance skills. The school building is composed of multi-level houses around a central core comprised of a dining and performance space, administration spaces, a media center, and gym. There are six home bases designed for 100 students each. Each house has a variety of spaces to accommodate different learning groups such as individual workstations, small group rooms, project labs, seminar rooms, and resource areas. Individual workstations are grouped by 16 and each owned by a student, and a pair of groups shares a common work area. This variety of spaces enables students to learn individually and also to work with an interdisciplinary team of teachers. The school is located within a natural habitat and wetlands, creating a useful setting for outdoor learning laboratories (see Cuningham Group Architecture, 2002). (See Figure 3 and Appendix.)

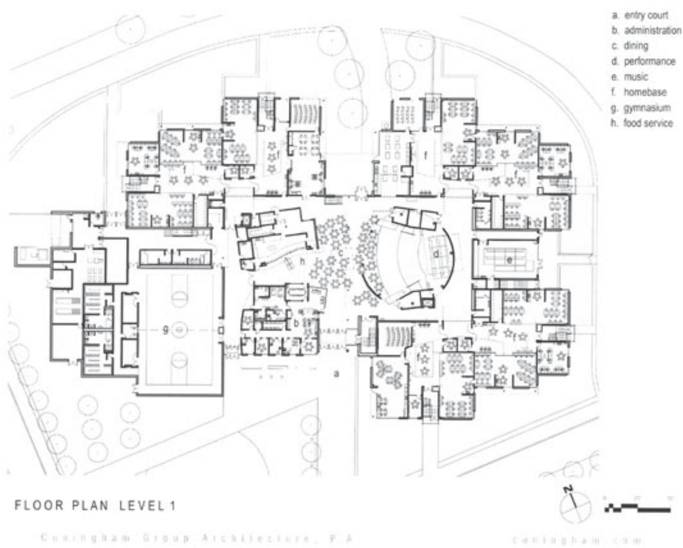

Figure 3a. 1st floor plan of Crosswinds Arts and Science Middle School, Woodbury, Minnesota, USA, 2001 (Cuningham Group Architecture).

Figure 3b. Homebase floor plan of Crosswinds Arts and Science Middle School, Woodbury, Minnesota, USA, 2001 (Cuningham Group Architecture).

5.2.5 Great Binfields Primary School

Basingstoke, Hampshire, UK, 2004; kindergarten – grade 5, 210 pupils
Architects: Hampshire County Council

This school is designed for 210 pupils with the possibility of expansion to 420. It has a unit for visually impaired children. The site is located in woodlands and serves as an exciting learning environment for children since the school has a close relationship with the landscape. It has large windows to allow natural light, ventilation, and great views. The environmentally conscious materials used are low maintenance and durable. The classrooms are arranged on the inner edge of a horseshoe-shaped plan. A hall, labs, library, and common space called "shared area" are arranged on the outer edge of the plan. Rooms and spaces are open with few walls connecting each other. The inner courtyard is dry and paved with sculptures to visually connect to outer woodlands. There are many individual learning spaces with IT capacity, such as the shared area, library, and information technology room.

Small individual learning and lab areas are also in regular classrooms. (See Appendix.)

5.2.6 The Classroom of the Future at Meadlands Primary School, Grey Court Secondary School and Strathmore School

Ham, Richmond-upon-Thames, Surrey, UK, 2005
Architects: Future Systems

This is one of the "Classroom of the Future" projects initiated by the national government. Thirty pilot projects by twelve local education authorities were selected and invested in. This new classroom is the creation of innovative learning environments to deliver the best and most effective education with the most advanced technology in the information age. It also has unique architectural features: flexible, organic, and colorful for creating a comfortable and pleasant environment. It is a stand-alone, factory-built prefabricated classroom made of glass-reinforced plastic. The egg-shaped classroom has a toilet, storage, and large space for individual and group learning. The internal space extends to an outside terrace by opening a glass wall. Students can display their work and communicate with each other inside and outside of the classroom by using wireless IT devices. IT is also used for the building technology such as automatic control of air, natural light, and acoustics. Three classrooms were constructed in a primary school, a secondary school, and a school for special needs (see Yanagisawa, 2006b; Department for Education and Skills, 2003). (See Appendix.)

5.2.7 Fredrika Bremer Gymnasiet Förslag (Upper Secondary School)

Haninge, Sweden, 2004; grades 10–12, 2,000 pupils
Architects: Kristian Lindgren Arkitektkontor AB

This is an upper secondary school composed of three academic units: Social sciences, natural sciences, and art/media/nursing. Each unit forming a community of 400–500 pupils is divided into several courses with up to 160 pupils. The new school building was transformed from an old 1970s building unsuitable for new teaching methods, containing features such as low ceiling heights, classrooms lacking variety, dark corridors, and lack of social spaces. There is a large open space with an atrium located in the center of the building that is shared by three units for student assembly and dining. This space also houses the auditorium, library, and special classrooms. Each academic unit has its own administration, various sized classrooms, labs, teachers' lounge, bathroom, and common space. Each unit common space with a variety of desks, chairs, and computers is designed for individual learning and communication. The building is open, flexible, and light with a skylight and courtyard. The materials used in the interior and the exterior are natural and sustainable. (See Appendix.)

5.2.8 Futurum Haboskolan

Balsta, Stockholm, Sweden, 1999; grades 1–9, 1,018 pupils
Architects: Jack Pattison

This school is located in a newly developed residential area. Students are divided into six working units of around 160 pupils and 16 teachers each. Every working unit has 1st–9th grade students, much like a small, self-contained school. In each unit, teachers with different specialties are teamed to teach and guide students' learning. Students tend to learn individually, following their own curriculum designed with the teacher and their parents. There are various learning spaces in each working unit such as several small classrooms for 5–10 students, a large open classroom, a covered outdoor classroom and a teachers' lounge as well. The large open classroom in the center of the unit is equipped with many computer and other IT devices for individual project-based learning. The main school building is L-shaped with working units along the perimeter, and shared facilities such as the lunchroom, stage, science, music, art, and textile room located in the middle. The library and some labs are in another building and are open to the public after school hours until midnight (see Yanagisawa, 2004). (See Figure 4 and Appendix.)

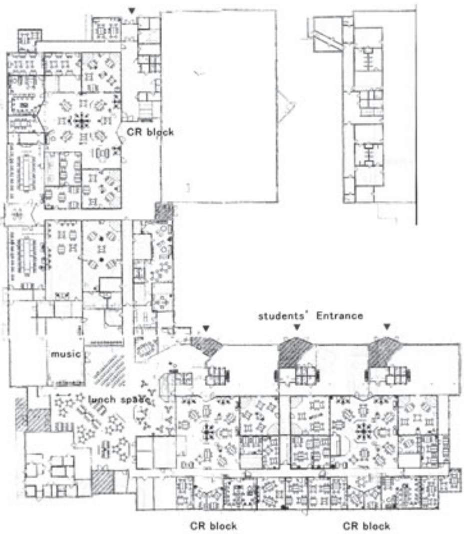

Figure 4a. Floor plan Futurum Haboskolan, Balsta, Stockholm, Sweden, 1999 Jack Pattison, Architect).

Figure 4b. Floor plan of a working unit, Futurum Haboskolan, Balsta, Stockholm, Sweden, 1999 (Jack Pattison, Architect).

5.2.9 Torpparinmaen School

Kaupunki, Helsinki, Finland, 1999; grades 1–9, 410 pupils
Architects: Seppo Hakli

This is an educational complex composed of a school, a youth club, and an adult club. The community people can use some shared facilities such as the gym and labs even during school hours. There is an open space with a two-story high atrium called "agora" in the center of the building. It is used for assembly, lunch, and also many community events. Classrooms and labs surround the agora. Glass walls enable classrooms to visually connect with the hallway and agora. The hallway is wide enough to set up individual learning spaces with computers and other learning resources. The agora is also used for various learning activities. Music, science, art, craft, and home science rooms are professionally designed to accommodate members of the community. The building has an oval-shaped plan and is made of reinforced concrete. The exterior wall with wood finish presents a softened facade to the neighborhood (see Ueno, 2005). (See Appendix).

5.2.10 Montessori College Oost

Amsterdam, The Netherlands, 2000; grades 6–10, 1,200 pupils
Architects: Herman Hertzberger

This school is a private, pre-vocational school for over 1,000 pupils. The school is composed of two parts: A five-story classroom tower and a one-story laboratories/gym building. There is a central, skylit open space between these two parts. It is used for lunch, performances, assembly, and artistic activities. According to Montessori's concept, the school focuses on education for individuality by providing various learning and social spaces. The classroom tower has a huge atrium with a five-story height, and various classrooms for accommodating different-sized groups and learning styles. It also has many social and personal spaces such as coffee nooks, lounge, and cloakrooms. Round-shaped wide stairs in the atrium are used for performances, meetings, and individual learning. The education in this school is also very unique in focusing on learning with computers and other IT devices, allowing individuals to work at their preferred place, and offering many optional classes. Even though it is a private school, some facilities are open to the public after school hours (see de Vries, 2000). (See Appendix.)

References

CAn+CAt. (2005). Gunma Kokusai Academy. Shinkenchiku, vol. 80 (pp. 125–134). Tokyo: Shinkenchiku, Inc.

Cuningham Group Architecture. (2002). Crosswinds Arts and Science Middle School, project report. Minneapolis, MN: Cuningham Group Architecture.

Department for Education and Skills (DfES). (2003). Classrooms of the future. London: DfES.

de Vries, T. (2000, July/August). Montessori College Oost in Amsterdam: Ankerpunten in een verticaale stad [Montessori College East in Amsterdam: Anchors in a vertical city]. Detail in Architectuur, 16–19.

Kristian Lindgren Arkitektkontor AB. (2004). Fredrika Bremer Upper Secondary School, project report. Stockholm: Kristian Lindgren Arkitektkontor AB.

New Design for Learning. (1999). The School of Environmental Studies Design, impact report No. 1. Independent School District 196.

Ueno, J. (2005). Schools in the World, No. 6: School Planning and Design in Finland. Kenchiku Gahou, vol. 311 (pp. 14–121). Tokyo: Kenchiku Gahou, Inc.

Yanagisawa, K. (2004). Schools in the World, No. 4: School Planning and Design in Sweden. Kenchiku Gahou, vol. 309 (pp.114–121). Tokyo: Kenchiku Gahou, Inc.

Yanagisawa, K. (2005). Schools in the World, No. 7: School Planning and Design in the Netherlands and Italy. Kenchiku Gahou, vol. 312 (pp. 98–105). Tokyo: Kenchiku Gahou, Inc.

Yanagisawa, K. (2006a). School's information technology and community networking abroad. School amenity, vol. 21 (pp. 38–41). Tokyo: Voix, Inc.

Yanagisawa, K. (2006b). School revolution in the UK and classroom of the future project in the 21st century. Facility of education, science, sports, culture, and technology, vol. 22 (pp. 88–92). Tokyo: REIF, Inc.

6 A Design Language for Schools and Learning Communities

Jeffery A. Lackney

6.1 Design Communication

Effective communication between educators and architects is an essential prerequisite to successful planning and design of schools, especially for those learning communities interested in challenging the boundaries of conventional models of educational practice. Educators lack a common language, a "lingua franca," for expressing their experience of the school as a place for learning and for articulating their environmental concerns with explicit reference to the activities of teaching and learning.

The most common form for communicating educational concepts to architects is typically called educational specifications that are a specialized form of what is more often referred to as the brief or program. Educational specifications typically detail the educational program of spaces, their size in square footage or meterage, their special requirements and relationships. The technical nature of "ed specs" as they are often referred to is that they do not always accurately represent what actually happens in the teaching and learning process, they are an abstraction from the realities of what actually occurs in the classroom. For all the good intentions of translating educational needs into architectural requirements, ed specs often fail to serve as a communication bridge between education and architecture. Ed specs become a poor stepchild of a far richer description of teaching and learning activity that remains to be communicated between educator and architect. Often this communication is strained by schedule and budget and is lost in translation never to fully come to the surface. Often arguments are made of the costs of spending time working through the details of the teaching process as it relates to facilities rather than working with prototypical design formulas that educational specifications often suggest. In fact, time well spent upfront understanding how teaching and learning actually will work will save time

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and money in the long run as changes will not be needed later in the process or even in occupancy.

Solutions to the problem of communication between educator and architect have most often focused on the idea of user involvement in the planning and design process. Educators are encouraged to share their insights into the teaching and learning process to, in effect, inform the design process. Architects must take the time to listen and further translate what they hear from these consultative sessions with educators. However, construction schedules, budget realities, and misunderstandings of specialized professional languages between educators and architects lead to educational environments that more often than not miss the mark in terms of supporting the needs of teaching and learning. User participation and design collaboration, it appears, are only part of the solution to the problem of design communication between educator and architect. Often, lay people are able to articulate their place experience in terms of physical comfort, crowdedness, safety, ownership and personalization. These attributes of place experience have emerged in the environmental psychology literature across a broad range of place types. Rather than connecting to specific elements and characteristics of building design, attributes of place experience are often global in the minds of users.

In this chapter, we propose that attributes of place experience such as comfort can, when seen as a broader pattern of behavior and activity, a design pattern if you will, can have the potential of creating a common language that both architects and educators can use to communicate and articulate their environmental experience with explicit reference to the purposes and activities of teaching and learning. This objective here will be to articulate the interface between the place experience of educators and school design leveraging not only the empirical research on educational environments, but also best practice of educators and architects.

The notion of the design pattern was probably best articulated by Christopher Alexander and his associates in a body of work that includes his seminal book A pattern language: Towns, buildings and construction of 1977. This chapter focuses on a subset of salient patterns for school design. Previous literature regarding the idea of the design pattern as way of organizing the school planning effort may also be of interest to the reader (see Lackney, 2003; Tanner & Lackney, 2006; Nair & Fielding, 2005; Moore & Lackney, 1995). In general, these authors, following the work of Alexander, have formulated design patterns through a process of translating available research and articulating best practice from a variety of sources within the educational, psychological and architectural literature. The school design patterns presented in this chapter form a language for the conduct of the school planning and design process.

6.2 Pattern Language

As Christopher Alexander suggested in his book A pattern language, a pattern describes a problem that occurs over and over again in our environment, and then describes "the core of the solution in such a way that you can use the solution a million times over without ever doing it the same way twice" (p. x). For Alexander, patterns do not imply absolute statements, rather they describe a set of relationships that respond to given certain conditions and circumstances that are by their nature ever changing. Patterns are intended to be used, questioned, modified, and reapplied to new circumstances. From a scientific point of view, patterns could be seen as representing testable hypotheses about the relationships between human activity and physical structure, and as such hypotheses can be falsified.

Of the 255 patterns Alexander and his associates first developed and articulated, at least ten patterns have a direct impact on the nature of school design. These patterns include University as a Marketplace, Network of Learning, Children in the City, Connected Play, Adventure Playground, Master and Apprentices, Teenage Society, Shop-front Schools, Children's Home, and Child Caves. Many more patterns are associated and related to these patterns in a lattice framework that interconnects all 255 patterns in a seamless whole. For example, Master and Apprentices links to Network of Learning and Self-Governing Workshops and Offices calling to mind present day discussions of project-based service learning and work-based learning programs. Children in the City may be associated with Parallel Roads, Promenade, Looped Local Roads, Bike Paths and Racks and Network of Learning giving the impression of the characteristics of built environment necessary to support children as they move through the city. Alexander's patterns are still highly relevant within the school planning field today and the reader is encouraged to further investigate this work.

6.3 Developing Patterns

The process of developing patterns for school design includes the use of both empirical and practical knowledge. Some of the earliest creation of the patterns for school design evolved from the review of empirical literature in the field of environment-behavior studies identifying reliable findings about the impacts of the designed environment on educational outcomes (Moore & Lackney, 1994). For instance, several decades of research into school size has demonstrated the effect of size on a variety of school factors from school culture and pro-social behaviors to student achievement (see Raywid, 1999, for a review of the literature). Translating this research into design patterns has led to formulation of patterns such as the small learning community, the neighborhood concept, and the schools-within-school concept. Another well established area of research that has provided evidence for patterns is that of class size that indicates significant relationships of smaller class sizes on improving behavior, satisfaction and achievement (Nye, 1992). Class size research provides support to the formulation of design patterns such as the small learning group, as well as, the advisor-advisee model being implemented in many charter schools in the U.S. (Thomas, Enloe, & Newell, 2005). Many other patterns have been developed with the empirical support of environmental psychology research that will be covered later in this chapter.

The second approach is to review and analyze the architectural literature looking at a range of educational facility design for successful best practices (Moore & Lackney, 1994). From the work of Design Share, in which over 400 exemplary case

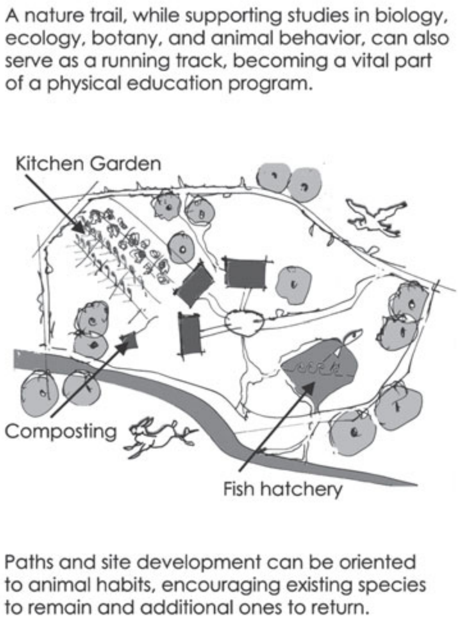

Figure 1. Indoor-outdoor connections pattern illustrating the graphical nature of the school design pattern that integrates verbal and graphic language (courtesy of Fielding Nair International, LLC).

studies have been collected on their website through a decade old international competitions, many patterns, such as the indoor-outdoor learning connection, the three-dimensional textbook, social breakout space, and creating a variety of places for learning that have emerged as having validity in many parts of the world even when the nature of those connections varies with climate and culture. This type of analysis can often be construed as subjective, biased by prevailing trends and unscientific. However, the experience of design inquiry by successful architectural practitioners should not be so quickly dismissed. From collective experience architects and educators when encouraged to reflect on their own practices have found certain designs to work better educationally than others. When combined with empirical studies, best practices can be further tested and refined. For example, empirical research supports the learning center or activity nock, a common pattern well known by early childhood educators: well-defined activity areas or "activity pockets" were found to increase the amount of time spent reading (Moore, 1986). Best practices, just as patterns have been described above, can be thought of as hypotheses in need of further testing, whether in the field of in the laboratory.

If a pattern is to be robust and usable, how it is identified, its verbal title, and the diagram that visually expresses the pattern are both important components. The redundancy between visual and verbal message is intentional. Some people are more visual and will understand and remember the visual image, while others will understand the idea better and remember the verbal title. Because the pattern is intended to express the essential idea, it can be used over and over again in many different contexts just as the words that make up a language form infinite sentences. Figure 1 (see Nair & Fielding, 2005) illustrates the linkage between visual and verbal information in creating a memorable impression of the need for schools to better connect indoor and outdoor learning activity. The intuitive nature of this pattern is highly provocative for educators and often inspires them to examine more closely the possibilities of on-site learning they have neglected in their teaching.

6.4 A Language of School Design

The patterns described in the following sub-sections outline what could be considered the core of a language that supports the demands of 21st century learning. There are many more patterns that could be examined than can be covered in this chapter and the reader is encouraged to further examination of a full range of patterns that have been developed for schools (Tanner & Lackney, 2006;

Nair & Fielding, 2005; Moore & Lackney, 1994.) The patterns that follow are organized from the inside out, starting with the learner and moving out to the larger community in which the learner is embedded. Each pattern builds on the one before it illustrating the interconnected nature of the pattern language for school design.

6.4.1 Home as a Template for School

An educational direction that has emerged in the United States over the past two decades is the make schools look and feel more like homes. The use of terminology such as house plans and neighborhood plans by architects reinforces this trend. Although there is little in the way of empirical research to support the idea of creating home-like school settings, there has been work by environmental psychologists and phenomenologists that suggest the importance of minimizing abrupt transitions between home and institutionalized settings, especially for very young children (Moore & Lackney, 1994). Many architectural elements such as home-like front yards and front porches, friendly entry sequences are all possible ways to reduce anxiety about school and reassure both child and parent (see Figure 2). Creating a home like atmosphere does not stop at the entrance. To further a sense of comfort, older students can be assigned to a homebase with individual desks and lockable storage space. Home bases should be located within small learning community. Lockers, if provided should be placed in smaller numbers in nooks or bays in areas where students are likely to socialize in a healthy way. The traditional 9" locker lined up in a hallway is not recommended.

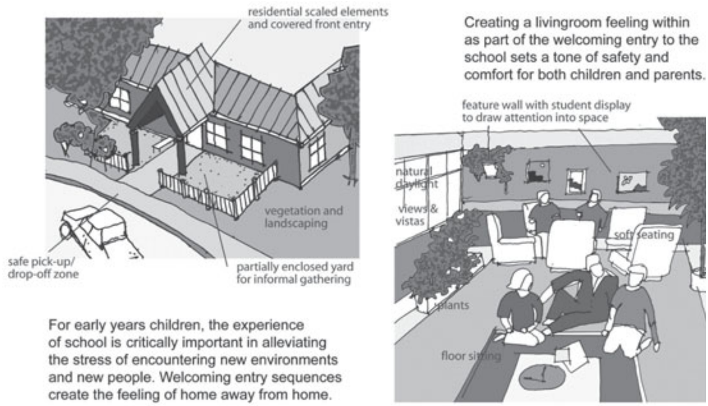

Figure 2. Home as a template for school (Jeffery A. Lackney and Fielding Nair International).

6.4.2 Space for Collaboration

Educational environments need to actively support active, self-directed, problem-, project-based, collaborative or cooperative learning strategies over traditional, lecture-oriented, discipline-focused, teacher-centered instruction (Johnson & Johnson, 1999; Costa & Liebmann, 1997). Collaborative learning prepares learners for the changing learning expectations in the real-world through an active learning process that teaches critical thinking, problem solving, teamwork, negotiation skills, reaching consensus, using technology, and taking responsibility for one's own learning (Wolff, 2001).

School planners and architects are developing a variety of school designs that support personalized, self-directed learning (see Figure 3). Wolff (2001) has identified a variety of features of collaborative environments: Variable sizes spaces that are easy to change to support several learning activities within the same space, and to encourage integration of courses and programs; individual work spaces that can be personalized providing a sense of ownership and teaches responsibility for one's own learning; faculty team spaces with adjacent material preparation areas and meeting space that encourages team teaching, mentoring of faculty and collaboration. Functional spaces for collaborative learning activities might include: Presentation spaces for individuals and teams to demonstrate their learning and share knowledge acquired with the larger learning community; the continued need for classroom spaces for direct instruction of concepts, content and skills; process galleries, studios that allow for the display of ongoing projects to showcase concept development; project space that pro-

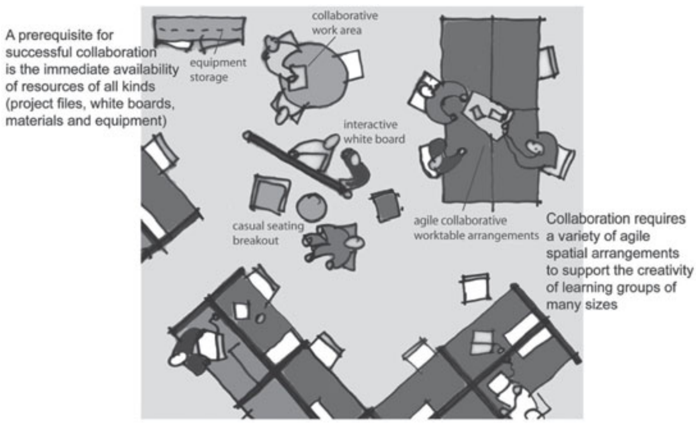

Figure 3. Space for collaboration (Jeffery A. Lackney and Fielding Nair International).

vides a variety of work surfaces, storage and access to technology to encourage critical thinking, problem-solving and teamwork; home base for gathering of learners and faculty to seek assistance and resources or hold group discussions; informal, non-classroom, learning spaces such as study spaces, lounges and outdoor spaces to provide areas for socializing, and serendipitous meetings that can foster creative thought and solutions to problems; and collaboration incubator, idea generation space to support creativity, teamwork, prototyping of concepts which can also encourage the involvement of local employers in the development of projects.

Social discourse and collaborative learning are critical to the development of well-rounded citizens. These skills are actually at the top of the list of qualification for success in almost any global profession. Corridors can be replaced with other kinds of spaces, which permit circulation but also serve the goals of social and emotional development. There are informal social gathering places for student to assemble in conversational groups throughout the school and on the school grounds. Some indoor collaborative spaces allow students to have access to full-service kitchen or mini-service area with a refrigerator, sink and or microwave. Collaborative spaces placed adjacent to more formal instructional areas can serve as additional informal learning breakout spaces. They are not visually or acoustically disruptive to more formal (quiet) instructional spaces. When spaces are used correctly, for collaborative work, noise is surprisingly not a problem, instead one experiences a healthy “buzz” of activity. It is when these spaces are not used as designed, as when teachers persist in lecturing to large groups of students rather than working in small groups, that acoustics can become a problem. Additionally, the technology of acoustical abatement provides a variety of strategies for attenuating sound such as sound absorptive materials on all room surfaces.

The space has adequate flexible seating and soft seating options with vistas to nature, street life and or active hands-on learning areas. Within the collaborative space there are areas for student display of events, work products and other announcements of interest to students. Unique floor and wall surfaces, accent lighting and other physical features delineate the collaborative spaces.

6.4.3 The Learning Studio and the Learning Suite

The conventional rectilinear shaped classroom with desks in rows and columns is the most visible symbol of an educational philosophy that emphasizes repetition, sameness, standardization, in short, an assembly line model of learning. Under this model, it made sense to regiment several classrooms next to each other and place them on long corridors that could be easily supervised. This

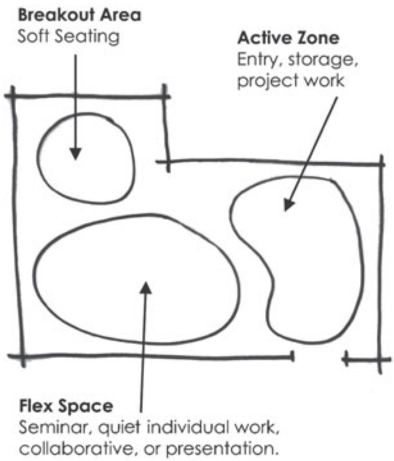

Figure 4. The Learning Studio (courtesy of Fielding Nair International, LLC).

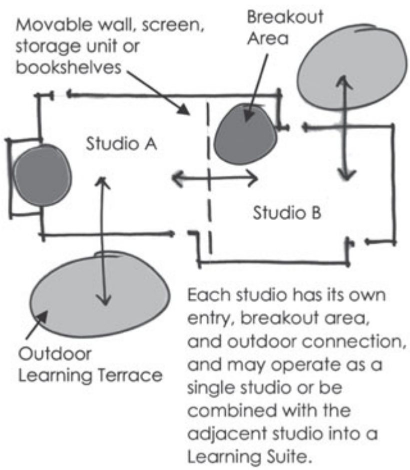

Figure 5. The Learning Suite (courtesy of Fielding Nair International, LLC).

model, that we might call the old paradigm, most closely represents nearly a two-century old pattern whereby the day itself could be broken down into 45-minute segments of prescribed activity. Under the new learning paradigm, the patterns of learning are such that many educators now advocate that students learn best if grouped in varying ages (multi-age), learning different things (differentiation) from different people (team teaching, cooperative learning) in different places (using the entire community as a learning environment), different ways (project-based) and at different times (block scheduling). The spaces set up for the old (assembly-line) paradigm would be extremely difficult to modify to function well for the new model that requires the need for multiple modes of learning in addition to lecture and recitation, such as large group discussion, small group cooperative learning, project-based hands on learning, as well as individualized and self-directed learning.

Is the rectilinear row and column classroom obsolete? Given that the classroom itself will continue in some iteration into the foreseeable future the model must be amended from a rectangular box to a more agile "Learning Studio" (see Figure 4). The term Learning Studio is sometimes used to refer to an L-shaped classroom with multiple activity centers (Lippman, 2005). The space lends itself to achieving many of the learning modalities outlined above.

The ability to combine Learning Studios into a "Learning Suite" (see Figure 5) expands the options for teaching and learning. The suite allows teachers to team-teach or for one to be outside the Studio doing research or fieldwork while the other monitors both studios. Students can engage in peer-to-peer learning, mentoring, and collaborative projects with students from an adjacent studio and learning.

6.4.4 The Small Learning Community

The literature on the effects of school size on a variety of school outcomes is well documented. Participation in school activities, extracurricular activities, student satisfaction, number of classes taken, community employment have all been found to be greater in small schools relative to large schools (Barker & Gump, 1964; Irmsher, 1997; Lashway, 1998; Raywid, 1999). As a result of the overwhelming evidence provided by this research, there is a rapidly growing interest in smaller school sizes and buildings (Washor, 2002; Lawrence et al., 2002; Levine, 2002; Nathan & Febey, 2001).

A small learning community is a fully autonomous or semi-autonomous grouping of no more than 150 students who share a common space. The prominent idea in creating small learning communities is to create small groups where everyone knows everyone else. If the school itself is not built small, Small Learning Communities can be created in a neighborhood like fashion with a central connector space acting as a unifying element. Ideally, each SLC should have outdoor connections and may contain its own multi-purpose social space (see Figure 6).

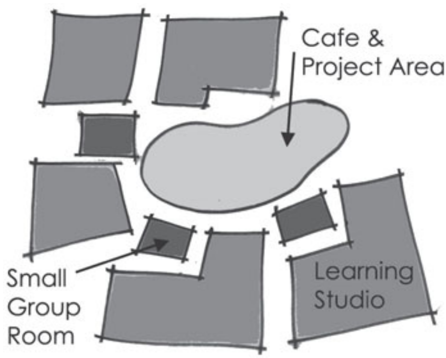

Figure 6. Small Learning Community (courtesy of Fielding Nair International, LLC).

These patterns form an unbroken whole starting from the learner out: Home as a Template for School leads to Collaborative Spaces that are included outside and within Learning Studios and Suites all within the context of a Small Learning Community. These patterns continue to integrate with Indoor-Outdoor Connections for learning described in a previous section as well as Connecting to Community itself through local business and community partnerships as well as global virtual connections. All patterns work off each other in creating a comprehensive learning environment that supports 21st century learning.

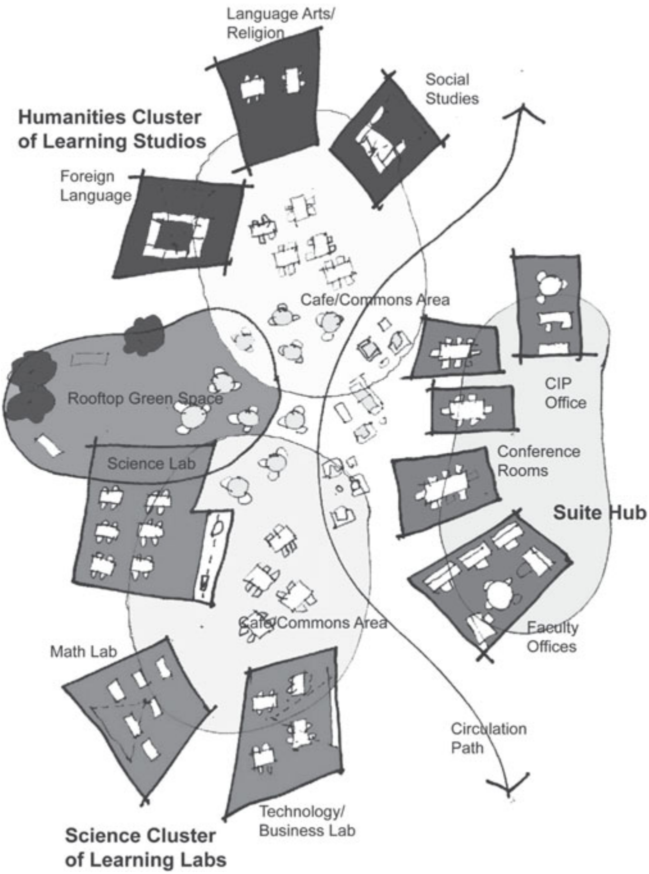

Figure 7. Cristo Rey High School Pattern Workshop (courtesy of Fielding Nair International, LLC).

6.5 Bringing It All Together

Patterns by their very nature imply organic connection: Learning studios and suites that have indoor-outdoor connections are more successful learning environments than those that do not have these connections. This section provides an example of how these patterns are integrated into a real school design project. The Learning Suite pattern developed for Cristo Rey High School in Minneapolis, Minnesota provides a worked example of how patterns connect and interrelate (see Figure 7).

6.5.1 Learning Suite – Cristo Rey Jesuit High School

Issue: In an effort to make learning more meaningful and relevant for urban youth, curriculum and instruction must become more integrated and focused on their personal real life needs and concerns.

Solution: Provide an agile physical setting capable of supporting teams of teachers to instruct large and small groups, as well as individuals on an "as needed" basis.

Features of the Learning Suite

- A Learning Suite is designed for 125 students in a single grade level (Freshman, Sophomore, Junior, Senior) and between 6–8 faculty members.
- Each Learning Suite has a minimum of five advisory groupings.
- Each Learning Suite has a Humanities cluster of 3–4 Learning Studios and a Science Cluster of 3–4 Learning Labs. Clusters are designed to create interdisciplinary synergy between related disciplines.
- A Learning Suite has a "Hub" that consists of shared faculty offices, a Corporate Internship Partner office, and 3 conference rooms for use as advisories as well as corporate partner meetings.
- A Cafe/Commons is a shared breakout space for the entire Learning Suite that provides flexible, multi-functional space for both academic and social activity. The Cafe/ Commons consists of cafe style tables as well as movable rectangular tables for small group study. In addition, soft seating provides cave space for students requiring a more focused and quiet setting for study.
- A rooftop green space is provided off the both the Commons and the Science Lab for use as both a social breakout and outdoor learning (environmental monitoring).

The act of creating this and other patterns for the project directly involved educators and administrators to ensure that Cristo Rey best practice was incorporated into the program patterns. Learning studios are clustered into Humanities and Science clusters as dictated by the school's curriculum. Each learning studio cluster is grouped around a Café/Commons space that serves both as a place of learning and as a place of socializing and eating. Both suite clusters have access to a green roof deck, with one of the science learning studios directly connected for outdoor science projects. A Suite Hub is closely associated with these clusters and contains various faculty support functions.

The final scheme (see Figure 8) indicates the final product that was a result of the patterning process with smaller learning communities separated by stairs and other elements each containing their own learning studios/suites and open collaborative areas.

Figure 8. Cristo Rey High School, Minneapolis, MN. Second floor plan illustrating the translation of the Learning Suite pattern with three small learning communities each containing learning studios and suites surrounding collaborative breakout areas (courtesy of Fielding Nair International, LLC).

6.6 Summary

There are particular aspects of school design and school planning that is suggested by this chapter that might be considered by designers and planners in creating "schools of the future."

As implicitly suggested in this chapter, the critical design characteristics of the school design process that should be avoided include the artificial separation between the activities of planning and the activities of design. These two activities are naturally interconnected and when there is an institutionalized separation between them, as in the use of educational specifications, miscommunications result that are regularly missed in the resulting school building. The tendency towards inauthentic user involvement in both planning and design continues to be a stumbling block resulting in non-functional design solutions. While expert planners and designers do bring with them best practice knowledge formulated through experience in a variety of project settings, integrating and respecting insights into local context and particular educational practices of both educational leaders and rank-and-file teachers are nevertheless critical to the resulting success of the project as an effective place for learning. With this said, the application of best practices and available research by school designers is often uneven and based on their familiarity with knowledge often outside their expertise. The Language of School Design offers a bridge in applying new knowledge to practice.

School planning as it is generally practiced today has the tendency of repeating patterns from an older societal paradigm of the industrial/manufacturing process. Rooms are standardized, schedules are regularized, teacher practices are uniform across whole districts and systems. There is within the teaching profession a general recognition and growing understanding that learning styles vary between student and that developmental capacities need to be considered in teaching holds promise that school design elements themselves will shift to accommodate these understandings. The Language of School Design is one such response to this recognition with its emphasis on a variety of learning environments, comfortable homelike character of spaces, among other elements.

Regarding aspects of current school design practice that work: The current practice of pre-design and architectural programming that has emerged from the innovations of the past generation of designers represents a practice that should not only be maintained but also expanded. In circumstances where educational specifications cannot be avoided, such as in large bureaucratic school systems, the act of reinterpreting specifications within a formal architectural programming process that proceeds schematic design can go far in translating abstract specifications into workable solutions.

Finally, this chapter has argued that the application of the pattern language provides an opportunity for innovation in school design and planning. Although in theory, the pattern language of Christopher Alexander has received some recognition as an important contribution to design generally, it has not been accepted or practiced in any systematic way in the profession at large. The Language of School Design as described in this chapter provides an innovative practical method for applying the theory of the pattern language to school design that is accessible to everyone involved in schools not just educational planners and architects.

We have proposed the use of the design pattern, a visual and verbal representation of a broader pattern of educational behavior and activity that forms a more organic common language that both architects and educators can use to communicate during design collaboration. The design pattern has the potential to override the abstract representations of teaching and learning often depicted in educational specifications. Design communication between educators and architects, it has been argued, is critical to effective planning and design of schools. The patterning process provides educators with a new tool for powerfully expressing their experience to architects directly.

References

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I., & Angel, S. (1977). A pattern language: Towns, buildings and construction. Oxford University Press.

Costa, A.L., & Liebmann, R.M. (Eds.). (1997). The process-centered school: Sustaining a renaissance community. Thousand Oaks, CA: Corwin. 168 J. A. Lackney

Irmsher, K. (1997). School size. ERIC Digest, Number 113. ED414615 97. Eugene, OR: ERIC Clearinghouse on Educational Management. Retrieved from http://www.ed.gov/databases/ERIC_Digests/ed414615.html.

Johnson, D.W., & Johnson, R. (1999). Learning together and alone: Cooperative, competitive, and individualistic learning (5th ed.). Boston: Allyn & Bacon.

Lackney, J.A. (2003). Thirty-three educational design principles for schools and community learning centers. Washington, DC: National Institute for Building Sciences (NIBS), National Clearinghouse for Educational Facilities (NCEF).

Lashway, L. (1998–99, Winter). School size: Is smaller better? Research Roundup 15, 2. Eugene, OR: ERIC Clearinghouse on Educational Management. Retrieved from http://eric.uoregon. edu/publications/roundup/W98-99.html on June 10, 2008.

Lawrence, B.K., Bingler, S., Diamond, B.M., Hill, B., Hoffman, J.L., Howley, C.B., Mitchell, S., Rudolph, D., & Washor, E. (2002). Dollars and sense: The cost effectiveness of small schools. Columbus, OH: Knowledge Works Foundation.

Levine, E. (2002). One kid at a time: Big lessons from a small school. New York: Teachers College Press.

Lippman, P.C. (2005). The L-shaped classroom: A pattern for promoting learning. Minneapolis, MN: Design Share. Retireved from http://www.designshare.com/articles/read.asp?apg=1021 on December 24, 2006.

Moore, G.T., & Lackney, J.A. (1994). Educational facilities for the 21st century: Research analysis and design patterns. Milwaukee, WI: Center for Architecture and Urban Planning Research, University of Wisconsin-Milwaukee.

Moore, G.T., & Lackney, J.A. (1995). Design patterns for America's schools: Responding to the reform movement. In A. Meek (Ed.), Places for learning. Alexandria, VA: Association for Supervision and Curriculum Development. Also available from ERIC Document Reproduction Service, No. EA 026224.

Moore, G.T. (1986). Effects of the spatial definition of behavior settings on children's behavior: A quasi-experimental field study. Journal of Environmental Psychology, 6, 205–231.

Nair, P., & Fielding, R. (2005). The language of school design. Minneapolis. MN: DesignShare.

Nathan, J., & Febey, K. (2001). Smaller, safer, saner, successful schools. Minneapolis, MN: Center for School Change, Humphrey Institute of the University of Minnesota.

Nye, B.A., Achilles, C.M., Zacharias, J.B., Fulton, B.D., & Wallenhorst, M.P. (1992, November).

Smaller is far better: A report on three class-size initative. Center of Excellence for Research in Basic Skills, Tennessee State University. Paper #5. Paper presented at the Mid-South Educational Research Association, Knoxville, TN.

Raywid, M.A. (1999). Current literature on small schools. ERIC Digest (ED425049 99). Charleston, WV: ERIC Clearinghouse on Rural Education and Small Schools.

Tanner, K., & Lackney, J.A. (2006). Educational architecture: Planning, designing, constructing, and managing environments for learning. Needham Heights, MA: Allyn & Bacon.

Thomas, D., Enloe, W., & Newell, R. (Eds.). (2005). The coolest school in America: How small learning communities are changing everything. Lanham, MD: Scarecrow.

Washor, E. (2002, August). Translating innovative pedagogical designs into school facilities designs. Unpublished doctoral dissertation, Johnson and Wales University, Providence, RI.

Wolff, S.J. (2001, September). Sustaining systems of relationships: The essence of the physical learning environment that supports and enhances collaborative, project-based learning at the community college level. Unpublished dissertation, School of Education, Oregon State University.

7 Criteria for the Judgment of the Quality of School Buildings

Rotraut Walden

The many descriptions of school projects compiled in this book have been systematically scrutinized in a qualitative fashion. The resulting criteria for the judgment of the quality of school buildings have been combined into a system. The approach was as follows. A system for the judgment of school buildings was developed, and the corresponding features pertinent for school construction were incorporated into the system. In the subsequent chapter 8, the most important features for the design of innovative schools are listed. Here, we did not hesitate to name aspects again that are “just good” and not a matter of course, while not necessarily being innovative. The chapter also addresses the most important mistakes that can be made by clients and architects alike in the planning of schools. All in all, an attempt is made to provide useful recommendations for the planning of schools of the future – internationally –, following the identification of important psychological conditions and processes in chapter 3.

7.1 Procedure

In the analysis of interviews and school descriptions by internationally practicing experts and architects, we used the facet approach, which will be described in the following.

Facet Approach

The facet approach was chosen to bring the multitude of aspects that might be relevant for a promotion of schools of the future into a systematic structure. (Borg & Shye, 1995, cf. Walden, 2007). This made it possible to create a connection between content and data collection approach in which the method emerges “intrinsically” from the content.

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User
(a1 = teacher)
(a2 = students)
Person (p) (a3 = parents) *evaluates the school*
(a4 = architect) *(cognitively / affective)*
(a5 = visitors)
(a6 = evaluators of photographs or 'on site')

for the various environmental levels, respectively

(b1 = site and infrastructure)
(b2 = facade, exterior)
(b3 = building)
(b4 = entrance area)
(b5 = classrooms)
(b6 = specialty and multipurpose rooms)
(b7 = interior, circulation areas, hallways, stairs)
[(b8 = heating, cooling, ventilation, lighting, acoustics, sanitary systems)]
(b9 = school yard, special (outside) areas, sports areas)
[(b10 = overall impression)]

with regard to the reactions

(c1 = work and learning performance)
(c2 = well-being)
(c3 = social interaction)

In addition, the person (p) assesses the aspects of the various levels with respect to the following criteria

(d1 = functional)
(d2 = aesthetic design)
(d3 = social – physical)
(d4 = ecological)
(d5 = organizational)
(d6 = economical)

and quality at the point in time

(e1 = currently negative aspects)
(e2 = currently positive aspects)
(e3 = innovative aspects)

as

(f1 = very conducive)
(f2 = conducive)
(f3 = neither)
(f4 = disturbing)
(f5 = very disturbing)
(f6 = no answer possible)

Table 7.1 The mapping sentence according to the facet approach for the promotion of a "school of the future" (cf. Walden, 2007; Walden & Borrelbach, 2012).

Architectural psychology views all involved parties – users, architects, planners, researchers – as being confronted with a multitude of stimuli that can influence the experience and behavior of the individual. It is often difficult to determine which of these aspects are especially significant, how they should be distinguished and how they influence each other. Also, it is not known in what manifestation they become important. Facet theory (FT) offers help in structuring the innumerable factors into environmental features with different manifestations (see environmental levels in the table below), personal units (expert, user, passerby), and subjective indicator reactions (learning performance, expressions of well-being, social interaction). In this, it is our fundamental assumption that there are such distinctions and that these can be investigated meaningfully. Facet theory offers a structural framework for doing this, one which often emerges 'intrinsically' from the content. In application, the theory is mostly understood not as an explanatory theory but as a methodological approach for social science. It consists essentially of two components: (1) In research design, it embraces the planning of experiments and investigations and the selection of samples; (2) in the analysis of data, it includes various evaluation approaches resulting from the contents. In addition, it consists of hypotheses which relate the two realms to one another.

General application possibilities for the facet approach are listed by Borg and Shye (1995):

1. Formulation of a first definition of the questions in an area that has so far hardly been investigated (such as, in this case, the basis for the interviews).
2. Situations in which a number of empirical observations and laws have been found whose interrelations are not explained. Very complex hypotheses can be derived from a facet system (an example are studies of quality of life, cf. Borg, 1986).
3. A study which has not been designed as a facet theory investigation can be retrospectively reframed and its data tested again. This also facilitates the comparison of very different studies in the same area of interest.

A *mapping sentence* expresses the relationships between different facets (categories such as persons, situations, and reactions). The facets are divided into subcategories or elements.

An example: A facet P is the set of all users. Subcategories of P would be P1 = teachers, P2 = students, P3 = parents, P4 = architect; P5 = visitors, P6 = evaluators "on site", P7 = evaluators of photographs, etc.

In addition, the facet P = set of all users could be further subdivided into further facets according to gender, age groups, marital status, and so on. The subcategories of the gender facet would then be “male” and “female.” The relationships between the various facets are expressed in a mapping sentence. The design of the interviews follows the mapping sentence which in turn is derived from the basics of architectural psychology and the results of pilot studies (criteria for the judgment of school quality).

Implementation of the Interviews
On the basis of comparative interviews of experts (cf. Walden & Borrelbach, 2012), respectively reanalysis of the descriptions by experts of 24 projects (cf. chapter 4 by Henry Sanoff, chapter 5 by Kaname Yanagisawa, and chapter 6 by Jeffery A. Lackney, and the descriptions of projects in the appendix) as well as a study by Walden (2007), we wanted to find out how school buildings of the future might be designed. We were interested in innovative solutions and recognizable trends and requirements. For this purpose, it was necessary to draw on special criteria. The school is a complex with components that must be analyzed. The guideline for the interview is organized according to a walk through the school and its selected facets. First, we ask the architects themselves for the provisions they consider successful, and then try to get at difficulties with a question for “critical” aspects. The special achievement of the architects, going beyond the regular commission for a building project, is to name the future-oriented aspects.

Guideline for Interviews About “Schools of the Future”

1. What do you consider especially good regarding:

    - the site and infrastructure
    - the exterior of the building
    - the building
    - the classrooms
    - the specialty rooms, multipurpose rooms – the circulation areas, hallways, staircases
    - the heating, cooling, ventilation, acoustics, and sanitary provisions
    - the school yard
    - the special (outside) areas, sports facilities?

2. What do you consider especially questionable in the same areas

   - the site and infrastructure
   - the exterior of the building
   - the building
   - the classrooms
   - the specialty rooms, multipurpose rooms – the circulation areas, hallways, staircases – the heating, cooling, ventilation, lighting, acoustics, and sanitary provisions
   - the school yard
   - the special (outside) areas, sports facilities?

3. What are some considerations that should definitely be considered for these areas as innovative in future?

4. To what extent are suggestions and proposals from students, teachers, and parents taken into consideration in planning the building?

5. What about potential future modifications, changes, alterations by students, teachers, parents?

6. Are the current regulations for school building construction still adequate?

7. What are some other considerations that you personally consider important?

Analysis of Results – Approach

For the analysis of the interview results, we first transcribed the interview tapes into regular written German and compiled the expert reports according to various categories. This approach is needed especially where the content-thematic level is the prime concern, and the interviewed person is asked to act as expert, witness, or information source. Subsequently, we applied the method of content analysis (here: Mayring, 2003; for quantitative content analysis see Rustemeyer, 1992; Groeben & Rustemeyer, 2001). Then we developed a taxonomy for the judgment of schools. Here, the results of previously completed studies on well-being in schools and office buildings were helpful (Walden, 2007). Criteria accepted for the taxonomy were the aspects of functionality, esthetic design, social-physical (here meaning its conduciveness for communication), ecology, organization, and economy. (For an explanation, see section 7.3 below).

The school complex to be judged was divided into the levels of:

- exterior
- school building
- entrance
- classrooms
- special-purpose rooms
- interior structure, circulation
- school yard and special areas.

We began to work through the interviews to identify the experts' answers to the respective questions. We marked the corresponding sentence parts with special symbols (see mapping sentence of the basic facet theory structure). Subsequently, we correlated the positive, negative, and future-oriented aspects. The last step was the production of a summary table of school quality (see table 7.2) where positive, negative, and future-oriented aspects of school design are combined. All the listed information was drawn from the interviews and descriptions by experts.

Interview Partners – Descriptions by Experts (Architects)
Who would be interesting discussion partners for this topic? Architects, of course! But how to get in touch with architects who have developed visionary ideas and their application in school design?

Our first step was to write to architectural magazines to find architects who had been active in school design. Based on the content of the latest copies of these magazines, the editors prepared a first list of architects of "schools of the future." All except one of the architects we selected according to various criteria responded quickly and were willing to be interviewed. Additional information was obtained from international architects with expertise in school design, in the United States (Henry Sanoff), the United States and Africa (Jeffery A. Lackney), as well as Asia and Europe (Kaname Yanagisawa), based on descriptions of 24 school projects from 11 countries on five continents.

Accordingly, we obtained answers from architect Peter Busmann in Cologne, Germany (personal communication, August 12, 1999), and Peter Hübner in Neckartenzlingen, Germany (personal communication, August 25, 1999; cf. also his comments included in this book). Written comments came from artist Friedensreich Hundertwasser († 2000) and his manager Joram Harel (personal communication, August 2, 1999), and, as experts, the psychologist and pedagogics professor Christian Rittelmeyer as well as the three architects who also contributed chapters to this book (Henry Sanoff, Jeffery A. Lackney, and Kaname Yanagisawa). The analysis of the interviews and written contributions about 24 projects will provide insights regarding selected "schools of the future" in the last part of the study from the viewpoint of the architects.

The Schools

The appendix contains photographs of all 24 selected schools, to illustrate main aspects.

Comprehensive School Brühl-South, Germany
Architects: Peter Busmann and Godfried Haberer, Cologne, Germany
(Case Study #19 – photographs see Appendix)

The special architectural attitude of these architects rests primarily in their understanding of buildings as the art of building. The inclusion of visual artists into the planning process of a building creates a lively dialogue between client, users, and architects, and between architects, the artists, and the building project. Another hallmark of this school is its largely ecological construction, which is based entirely on the principles of Hugo Kükelhaus (1971, 1988).

> *"With the addition to the previous school design, the complex receives an independent image integrated into the urban context. Functionally and structurally separate, the existing building and the addition remain clearly recognizable. The center of the new building is the solar house with its pyramidal shape. The courtyard of the glass house with its greenery is the main break area but also serves as access and circulation hub. The ecological concept consists of passive use of solar energy (as in the solar house) and natural air conditioning (using, among other things, the temperature storage of its concrete mass). The interior organization follows the principle of a 'school within the school.' The regular classrooms are grouped into clusters of four, each with its set of auxiliary spaces for the head of the level, and advising teachers. In addition, there are spaces for individual work, group projects, and after-school activities throughout the complex. The organizational and economically advantageous building schematic permits micro-additions to each classroom as well as macro-expansion."*
>
> *(Busmann and Haberer, 2005).*

Decision for addition. An existing school on the site needed to be expanded. The city government quickly reached a consensus to the effect that the new school should not be built in the style of the first complex dating from the 1970s.

Organization. The center of the school is the solar house with its glass roof, where administration offices, teacher's rooms, conference rooms, and various multipurpose spaces (for example, the arts room) are located. The glass roof creates a light-bathed interior courtyard from which the separate classroom wings are accessed. During the walkthrough of the school, the architect emphasized his concern that the school have a "gesture." Looking at the schematic, this school gives the impression of a place with open arms inviting users and visitors to enter.

Exterior. The three exterior courtyards offer a variety of activity opportunities for the breaks. Nearby fields and meadows create a close connection to nature. Rain water is not channeled through the usual gutters and downspouts into subterranean storm sewers, but is first collected in a paved canal which turns into a small creek when it rains and so creates yet another experiential space.

Facade. For the most part, the exterior wall is covered with an insulating stucco in a light yellow hue. For the sunshades, a blue color was selected. The center of the exterior wall has a wooden siding whose colors change according to its different degrees of exposure. Hardly any part of the building showed signs of graffiti or vandalism at the time of our visit.

Covered interior courtyard. The center of the school is the interior courtyard covered by a pyramidal glass roof, which also appeals through its garden designed in a mediterranean style. Freely growing vines, palms, orange and olive trees as well as a solar-driven creek create a close connection to nature and ensure that this space is used for many events and activities.

Classrooms and hallways. The hallways which are "spliced open" create small spaces on all levels which can be used by students and teachers for independent work and other activities. In addition, experiential spaces were created which were made inviting by means of small flower beds. Seating and tables invite users to linger and create informal meeting spaces.

Classrooms. The shape preferred by the architects is the pentagon, because of its analogies to the proportions of the human body. With this idea in mind, they created classrooms, all of which are individually designed down to the large window areas and ergonomic furniture. These spaces activate all senses, and through the senses the entire body and soul of the human being. The design of spaces which invite the creative potential of the children is a creative act.

Teachers' lounge. In the teachers' room, there is a separate work space for every teacher. The desks are arranged in small groups that are conducive to communication and teamwork. In addition, there is a small quiet room for rest and meditation.

Color design. The color design of the Comprehensive School Brühl-South is based on Goethe's color circle. Its six colors radiate out into the outer ring where the four segments there each partake of two colors. These are related to the four realms of the human spiritual life: red and orange to reasoning; yellow and green to understanding; green and blue to sensuality; purple and red to imagination (see Schulze, 1994).

Protestant Comprehensive School Gelsenkirchen (EGG), Germany
Architect: Peter Hübner, Neckartenzlingen, Germany
(Case Study #20 – photographs see Appendix)

This school was designed as a small town with many houses for living and learning. Guided by the architect Peter Hübner and his team, the children were allowed to design their own school house. The first student designs of schoolhouses were already translated into blueprints and constructed. During the following five years, a new schoolhouse was added every year. Five single schoolhouses together form a complex in which the classes live and learn. The children remain in "their house" until they change over to the secondary level. Each unit not only has a class/living room but also a gallery, sanitary installations, a break room, but also a garden, which the children have to care for, and a separate entrance. Specialty and multipurpose rooms are located in "houses" along the town's "main street." Each house has a sign with its own name. Included is a "city hall" which forms the connection between the school and its neighborhood, where neighborhood psychologists and social workers have their workspaces.

The office of Peter Hübner worked intensively on the project of the Protestant Comprehensive School (EGG) for eleven years from the original competition in 1993 until its completion in 2005. It represents the sum total of their experience to date with human school design (Hübner & Beierlorzer, 2005): Schools are places for living and not mere institutions for teaching and learning. Hugo Kükelhaus already stated this convincingly in his book Von der Tierfabrik zu Lernanstalt (From animal factory to learning institution) in response to the short-lived fashion for windowless schools (1988). The EGG is a multicultural, multi-confessional neighborhood school with an emphasis on ecology, and it is run as a five-track comprehensive school with a three-track secondary level from the fifth grade to the Abitur (educational certificate qualifying for university entrance;

corresponding to the AA degree in US colleges). Though it is operated by the Protestant Church of Westphalia, its student intake comprises about 30% Catholics and 30% Muslims, and thus meets a considerable demand for integration. It sees itself as a community school and fulfills a significant social service for the Bismarck neighborhood, which suffers from unemployment of up to 30% among its workers of mostly Turkish origin. The ecological emphasis of the school is realized not only in its instruction but also in the architecture, especially in the choice of construction materials and the solar energy concept.

The school was designed like a little town in which an interior market square and street are surrounded by the common rooms of the large school. The single units were individually planned by eleven different architects in the office. Intentionally, it was not to be a school designed according to one single concept by one designer but have a multifaceted appearance like a naturally grown town. This is realized down to the naming of the spaces and houses: not "cafeteria" but "tavern," not "administration" but "city hall," not "auditorium" but "theater." (Hübner, 2005)

For our topic, several things are important here: First, variety, individuality, acceptance, identification, and well-being within the overall complex have already been achieved with the central arrangement; but secondly, the key for the entire school lies in the classrooms which create in most visitors the strong impression that they are not in a school. Many have remarked that the outside gives more of a sense of a Danish vacation village, and the interior is reminiscent of some place in Tuscany.

In its final phase, the EGG will accommodate almost 1,300 students. Each class with 30 students was seen as the smallest unit and given its own "house," entrance, foyer, wardrobe, restrooms, classroom, gallery, and private garden. Most importantly for the possibility of creating a sense of identification, students were given the opportunity to do their own planning. The architects used the class community to create really original and individual classroom designs. The result of this community planning process is the surprising variety of the different solutions – in spite of the common size of 9 × 14 meters. Whoever attempts to design buildings with lay persons, and especially with children, must have the ability to listen so as to let dreams become reality. The incredible passion with which the children became engaged in the development of their own classroom houses confirms the participation thesis established in previous chapters (see chapter 4 by Henry Sanoff).

Martin Luther Gymnasium (High School) (MLG) and Elementary School, Wittenberg, Germany

Renovation with the guidance of artist Friedensreich Hundertwasser
(Case Study #21 – photographs see Appendix)

These two schools are located in the middle of the "Trajuhnscher Bach" neighborhood dominated by prefabricated apartment buildings, which was developed in the Luther town of Wittenberg in the 1970s and 1980s. The Martin Luther Gymnasium, (now part of the Luther Melanchthon Gymnasium, following its 2006 amalgamation with another Wittenberg high school, the Melanchthon-Gymnasium), built in 1975 for about 1,400 students, was ready for renovation. Around 1993, some of the school's art classes developed ideas for remodeling that were in line with the art and architecture of Friedensreich Hundertwasser, probably best known for the colorful and undulating "Hundertwasser House" apartment building in Vienna. First contacts were established between the county of Wittenberg and the artist's agent. The school's principal, Michael Sandau, Mrs. Kummetz of the county government, and student representatives traveled to Vienna to visit Hundertwasser's agency and expressed a desire for Hundertwasser to become involved in the renovation project as an "architecture doctor." According to Hundertwasser's agent Joram Harel (personal communication, August 22, 1999), "Hundertwasser spontaneously declared his availability, without charge, for the architectural renovation of this prefabricated building." A revised plan was prepared by the end of 1996. "Besides well-known elements such as curving roof lines and facades, golden cupolas, diversified facade designs with ceramic materials, colored stucco, and so-called "tree tenants," this concept also included conserved parts of the building that reveal the original prefabricated panel construction. In this way, the old and the new were joined in a exciting dialogue.

Changes in the exterior were accompanied by inside spatial reorganization. A performance space with a stage for theater events was created, as were green roof areas that also can be used for instruction. With its numerous innovations, this Wittenberg school became one of the most innovative schools in Europe. Since 2,000, there have been about 65 computers in many of the specialty rooms, which are connected in a school-wide network and have internet access. All students have free internet access for their studies, or just to surf. Besides the two new computer sciences labs there is also a modern media studio where films and videos can be developed digitally. An observatory gives a practical angle to astronomy instruction and allows students to "reach for the stars." Designed by students, the mathematics room was transformed into a genuine experience. During project days, coordinate systems, algebraic symbols, and graphs were drawn on the walls, to make the room look like a true math room as well as fitting in with the overall design of the school. In this, an important factor was the contribution by artists. As in all other areas, engagement is needed to make great achievements possible. A gallery, unique in schools, is located on the upper floors, where pictures by students are exhibited side by side with work of contemporary artists. This school is recognized as a prime example of successful renovation of the prefab school type "Erfurt II," which was built more than 550 times between Thuringia and the Baltic sea in the former German Democratic Republic.

7.2 Development of a System for Judging the Quality of Schools of the Future

In the following, we will present the results of the interviews and the analysis of the contributions of architects who have been internationally active in school design, in tabular form. The analysis proceeded as follows:

1. All interviews and descriptions were analyzed according to the criteria described above.
2. The individual results were entered into a final table which summarizes "critical aspects," "positive aspects," and "innovative aspects" for school construction.

The Judging System and its Development

For the two facets "environmental levels" and "criteria" in the mapping sentence shown in Table 7.1, the contents are now named in a system, shown in Table 7.2. The divisions of the following system into subcategories correspond to the school design constructs of the mapping sentence (in analogy to the environmental levels: facade, school building, etc. and the criteria function, esthetics, etc.).

The structure therefore followed six criteria (see Walden, 2005; 2007): Environments can be judged using six criteria, namely the functional, esthetic, social, ecological, organizational, and economic. These criteria are developed by applying the basic central themes of architectural trends, such as "form follows function" etc. to environmental psychology. What is meant by this is that functional aspects save time and energy; for example, layout, way finding, and quality of materials. Esthetic design results in feelings of beauty or newness. Social-physical aspects can result in conflicts that arise from simultaneous use of one setting by multiple parties (concentrated lessons disrupted by someone using a pneumatic drill in the vicinity) or in opportunities through communication. Ecological aspects mean that the ecological consequences of a building's existence are taken into account – from breaking ground via recycling to health concerns. Organizational aspects comprise the space-time breakdown of resources, provision of information, materials and storage facilities for logistics and sharing methods for task cycling. Economic aspects cater to the possibility of the entire school's cost-benefits calculations concerning the building.

The development of the mapping sentence and the judgment system is a continuous task, adapted to the specific conditions of each respective project. What the mapping sentence and the system have in common is their subdivision into subcategories according to an imagined walk through the building. The system was developed from the first pilot study in which six school projects in Germany were judged, up to the present analysis. The system serves as an item pool for questionnaires, and as the basis for guidelines for school construction in the various countries.

References

Borg, I., & Shye, S. (1995). Facet Theory. Form and Content. Thousand Oaks, CA: Sage.

Borg, I. (1986). Facettentheorie: Prinzipien und Beispiele [Facet theory: Principles and examples]. Psychologische Rundschau, 37, 121–137.

Borg, I. (1996). Facettentheorie [Facet Theory]. In E. Erdfelder, R. Mausfeld, T. Meiser & G. Rudinger (Eds.), Quantitative Methoden der Psychologie [Quantitative methods in psychology] (pp. 231–240). München: Urban & Schwarzenberg.

Busmann, P., & Haberer, K. (2005). Project description of the Gesamtschule Brühl-Süd. Retrieved from www.busmann-haberer.de/bauten/index.php on March 10, 2007.

Flagge, I. (Ed.) (1996). Eine Architektur für die Sinne: Busmann + Haberer [An architecture for the senses: Busmann + Haberer]. Berlin: Ernst & Sohn.

Groeben, N., & Rustemeyer, R. (2001). Inhaltsanalyse [Content analysis] (pp. 233–258). In E. König & P. Zedler (Eds.), Qualitative Forschung [Qualitative Research]. Weinheim: UTB.

Hübner, P., & Beierlorzer, H. (2005). Kinder bauen ihre Schule. Evangelische Gesamtschule Gelsenkirchen [Children Build Their School: Protestant Comprehensive School Gelsenkirchen]. Stuttgart: Karl Krämer.

Hübner, P. (2005). Kinder bauen ihre Schule. Children make their school. Evangelische Gesamtschule Gelsenkirchen. Stuttgart/London: Edition Axel Menges. (In English and German).

Kükelhaus, H. (1971). Organismus und Technik. Gegen die Zerstörung der menschlichen Wahrnehmung [Organism and technology. Against the destruction of human perception]. Frankfurt am Main: Fischer.

Kükelhaus, H. (1988). Unmenschliche Architektur: Von der Tierfabrik zur Lernanstalt [Inhuman architecture: From animal factory to learning institution] (6th ed.). Cologne: Gaia.

Mayring, P. (2003). Qualitative Inhaltsanalyse. Grundlagen und Techniken [Qualitative content analysis. Foundations and techniques] (8th ed.). Weinheim: Beltz.

Rustemeyer, R. (1992). Praktisch-methodische Schritte der Inhaltsanalyse. Eine Einführung am Beispiel der Analyse von Interviewtexten [Practical methodological steps of content analysis. An introduction using the example of interview text analysis]. Münster: Aschendorff.

Schulze, S. (1994). Goethe und die Kunst [Goethe and the arts]. Stuttgart: Hatje.

Walden, R., & Borrelbach, S. (2012). Schulen der Zukunft. Gestaltungsvorschläge der Architekturpsychologie [Schools of the future. Design proposals from architectural psychology] (7th ed.). Heidelberg: Asanger.

Walden, R. (2005). Assessing the Performance of »Offices of the Future.« In W.F.E. Preiser & J.C. Vischer (Eds.), Assessing Building Performance: Methods and Case Studies (pp. 118–127, 229–234). Oxford: Butterworth-Heinemann.

Walden, R. (2008). Architekturpsychologie: Schule, Hochschule und Bürogebäude der Zukunft [Architectural psychology: School, university and office building of the future]. Lengerich: Pabst Science Publishers.

For table 7.2. please refer to the following pages 215–222. System for judging the quality of school buildings (corresponding to a virtual walkthrough of the different areas of a school). Six criteria for the judgment of school quality are specified.

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Functional:	• Optimal site? • Protected from immissions? • Early consideration of situation? • Does the architect have a say in site selection? • Context/ surroundings? • Access? • Integrated in city/ community? • Accessibility?, • Infrastructure • Centrally located • School open to city/ community • Site dimensions • Different identifiable zones	• Educational concept for the building • School integrated into city/ community • School designed like a small town • Especially for comprehensive schools: walking distance? • Average school size (desirable:300 students for elementary schools, 600 for secondary schools) • Users' right to influence decisions • Accessible learning resource center as a core of the school • School furniture and workstations designed for information technology (IT) • Spaces supporting instructional methods using IT • Safety/ security provisions	**Vehicular access** • Central entrance easily visible • Easy orientation • Each building with its own entrance • Connection to classrooms • Places to meet, to linger • Inviting? • Divided into different zones • Showcases for exhibits • Space for activities • Protected from noise and pollution • Glazing (often inadequate glazing for economic reasons) • Covered entry	• Space per student • Appropriate layout for teaching methods • Cluster patterns • Appropriate sizes for intended use (educational architectural concept) (desirable: class sizes of max. 20–25 students) • Multifunctionality • Possibility for differentiating provisions • Suitable for 'open instruction' • Windows with glare protection and light-diffusing glass • Ventilation system • Opportunities for retreat to privacy • Spaces with different levels	• Centrally located • Short distances • Orientation and identification of spaces • Accessibility • Multi-functionality • Usable for adult education? • Technical equipment versus atmosphere • Accessible for disabled users • Connection to supply storage • Up-to-date-ness • Positioning of electrical sockets and faucets • Storage room • Library for students and community	• Wayfinding clarity • Space for hallway areas • Short walking distances • Hallway arrangement • Connection to classrooms • No long corridors • Hallways with street character • Hallways ending in 'plazas' • Clear interior shape • Good signage (written or symbols) • Accessibility for disabled users (elevators) • Signage for blind users	• Size and arrangement of areas • Offering multiple activity opportunities, multi-functionality • Differentiated zones • Identifiable areas e.g. • for assembly, noisy play, meeting, play • Useful setting for IT- based outdoor learning laboratories (wireless) • Differentiated pavement materials • Partially covered outdoor areas • Accessibility for disabled users

Environment Levels *Criteria*	**Facade, Exterior**	**School building**	**Entrance**	**Classrooms**	**Specialty Rooms**	**Interior Organiza-tion/ circulation**	**School yard/ Specialty areas**
Functional: *(continued)*	• Accessible for people with disabilities • Slopes too steep? • Short access routes • Parking availability • Safe bus drop-offs • Integration into lo-cal urban structure	• Protective roof? Distinctive roof-scape? • Child-appropriate scale • Accessibility for disabled users; elevator • Effective Commu-nication regardless of user's sensory abilities? • Hazards min-imzied? • Houses with closed classroom, open classroom, art & science area, home bases, media cen-ter, teacher station • Adequate space for teacher worksta-tions • Group work space for teachers esp. for all-day schools	• Adequate for disabled users • Capacity • Architectural emphasis	• Natural light • Number of windows • Individual furnish-ings • Cabinets on wheels • Window sills for writing or flowers/ exhibits • Blackboards fixed? (Number and flexibility of black-boards) • Possibility for re-positioning/ divid-ing space) • Students to de-velop sense of responsi-bility for the space • Students respon-sible for cleaning and maintenance • Positioning of elec-trical sockets and faucets • Designated student storage	• Reading area, com-mon work area • Wet corner • Student lounge • Teacher's worksta-tions • Computer center • Cafeteria • Music rooms suitable for performances • Acoustics • Facilities for hands-on project based learning, development of presentation and performance skills • Individual learn-ing spaces with IT capacity such as a shared area, library, IT room	• Hallway multi-functionality	

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Aesthetic/ formal design	• School should reflect the residential character of the neighbourhood (if positive) • Pleasing landscape • Opportunity for user design versus hiring landscape architect • Positive graffiti • Space for school gardens and green areas • Flowing boundaries • Pond or fountain • Play equipment • Large window areas	• Adapted to surroundings • Students to be involved in planning and construction process • Art in the building by students rather than artists • Traces of appropriation by students, teachers, parents possession • Possibly using several architects • Color design by color specialists/ artists • Color differentiation • Information legibility – signs, shapes and materials • Color washes/appealing graffiti • Art galleries	• Planting • Provision of a pond or fountain • Partially covered • Abundant natural light • User design • Showcases for exhibits • Color markings • Brightness	• Creativity is expressed • Displays of self, traces of appropriation, personalization • Participation by teachers, parents, community Identification • Individualized furnishings • Pleasing views to nature, street life or hands-on learning areas • Possibly not rectangular spaces • Plants, flowerbeds in windows • Technical details, e.g. lighting Color scheme (warm hues in cold rooms, cold hues in warm spaces) • Furiture arrangement • Space dividers • Provision for exhibits • Personalized living atmosphere	• Child-appropriate • individual furnishings • Experiental, memorable spaces • Room for user design and appropriation • Away from 'lecture hall' scheme • Individualized furniture, flexible, organic and colorful	• Lighting mode • Many windows • Appropriation/ displays by students as well as work by community artists • Exhibit opportunities • Different floor materials • Railing/ handrail design and detailing • Plants • Well–lit stairways	• Space for specialized areas/ activities • Design of outdoor areas in cooperation with landscape architect (sense of ownership) • Boundary marking through plants • Ponds, fountain • Herb and vegetable garden; fruit trees, • Creating different zones on different levels • Playground equipment • User design

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Social-physical	• Closeness to town/ neighborhood • Open to community • Possibility for meeting points • Zones for lingering • Balancing easy overview with need for intimate spaces • Building as a social process involving all users • Guided participation • Distributed responsibility • Design by students, teachers, parents • A place for a bonfire	• Integrated into city fabric • Number of meeting points versus retreat opportunities • Different zones • Spatial and social support → • Schools = places for living (feeling at home) Common home • Consideration of user needs/ desires • Key access for students • Involving students in cleaning building • Kitchen for (warm) drinks • Coffee nooks • Vending kiosks Participation by parents, teachers, community members, Children/ Parent involvement – parent volunteerism • Social Centers; breakout spaces appropriate to culture and climate	• Meeting places/ zones • Opportunity for common activities	• Density, crowding • Meeting place • Private area for the class • Possibility for retreat to privacy or activity nodes • Separate 'houses' for each class? • Seating arrangement • Retreat opportunities for small groups into niches/ terraces/ galleries • Core classes offer social support • Spatial support • Children stay in one class as long as possible as a living space/ home • Better architect–user community relations through common construction work	• User design/appropriations/displays of self • Away from lecture hall setup (discouraging rows of desks facing teacher) • Differentiated zones • Learning Centers • Acoustic insulation • Teacher work room with library • Workstations composed of pods with 10 pupils each • Youth club, adult club • Use for community activities	• Differentiated zones • Opportunity for making contacts with other students • Meeting place with opportunity for lingering • Hallways ending in 'plazas' → giving rise to social encounters • Wide hallways • Spaces also for IT use • Hallway as community street • Glass walls enable classrooms to visually connect with hallway and Agora	• Spaces for meeting and privacy retreat • Covered spaces for use in rainy weather • Areas for sports activities, e.g. soccer field or badminton • Adequate recreation areas • Maintaining overview and control • Adequate seating opportunities • Social centers; breakout spaces

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Social-physical *(continued)*	• Common Cleaning and maintenance of school compound by students • Prevention of vandalism • Sufficiently spacious	• Spaces for individual learning in all parts of the school, preferred places and common spaces • Facilities for networking between school and community • Face-to-face-communication rather than virtual communication by means of IT • Learning studios, suites, and small learning community (desirable: communities of 150 students		• Construction as a social process • Acoustic insulation between classes • Conflicting uses • Key privileges for students • Appropriation/ sense of ownership • Small side spaces for support of individual students • Social centers			
Ecological	• Integration with surroundings • Close proximity to heavy traffic roads or highways, railways	• Comfort • Connection to nature area • Indoor-Outdoor-Connections facilitate outdoor teaching • Plants in and near school building • Sodded/ planted roofs	• Use of natural light • Energy loss through drafts? • Thermal insulation • Provisions for recycling trash	• Abundant natural light; lighting type and intensity • Connection to garden (also with IT connection)	• Energy-saving climate control as well as individual manual control • Thermal insulation • Carpeted space for exercise and relaxation/ rest training	• Temperature control • Drafts? • Thermal insulation • Environment and healthy materials?	• Natural vegetation • Trees • Areas separated by means of vegetation, not fences • Provision of biotope and green areas, fruit trees, herb garden • Trash separation for recycling

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Ecological *(continued)*	• Noise • Opportunity to work outside in good weather • Sports facilities • School garden • Pond or biotope • Cultivated land and wilderness → enhances student learning process • Vegetable garden, fruit trees with usable, visible harvest • Herb gardens → pleasant fragrances • Creating habitats for animals • Rainwater collection • Energy conservation measures; installation of solar collectors	• Acoustics; noise insulation • (Automatic) temperature, air control • ventilation • Thermal insulation • Use of local construction materials • Environment-friendly materials • low maintenance and durable - sustainable • Use of alternative energy sources e.g. solar energy • Easy access to lawn areas for disabled users • Program and display of hot water generation • Atrium, Agora • Skylight • Courtyard • Building orientation (north-south) depending on climate	• Plants • Acoustics • Cleanliness	• Indoor-outdoor connections • Abundant plants • Acoustics and noise insulation; noise-reducing walls and floors • Air quality; cross-ventilation • Thermal insulation • Energy-conserving thermostats • Environment- and health-friendly building materials • Possibility for individual (manual) control of noise, lighting, sunshades, temperature, combined with automatic control technology (intelligent buildings) • Adequate sanitary facilities (noise/ odors) • Provisions for recycling	• Quiet rooms • Natural lighting • Facilities for project-based learning with an environmental theme	• Recycling provisions • No long noisy corridors	• Rainwater collection and water recycling • Play equipment stimulating all senses „Sensory experience area“ • Safety and security: accidents, criminal activity

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Organizational	• Integration into urban context and infrastructure • Good connection to town/ community • Flowing borders • Maintaining the natural context	• Opening the building toward city • Integration into community life • Good overview and orientation • Signage • Emergency exit routes • Elevators for freight and disabled users • Many regulations? • IT technology facilitating organizational processes	• Meeting point • Signage (written or symbols) • Vehicular access in emergencies	• Educational specifications: links between teaching methods and design (team-teaching, small group activities) e.g. “L”-shaped classroom • Spatial arrangement appropriate to teaching methods: lecture, recitation, discussion, cooperative learning, project-based hands-on learning, as well as individualized and self-directed learning • Small workrooms to be adjacent to their classrooms • Accessibility • Centrally located • Adequate space per student • Participation in decisions and responsibility by students • Possibly separate ‘houses’ with restrooms, storage for each class	• Good location • Short walking distances	• Wayfinding Clarity • Short distances • Central hallway • No long corridors	• Centrality, good access • Partial conservation of natural surroundings • Security provisions • Educational specifications: links between teaching methods and garden-design (team-teaching, small group activities)

Environment Levels *Criteria*	Facade, Exterior	School building	Entrance	Classrooms	Specialty Rooms	Interior Organization/ circulation	School yard/ Specialty areas
Economical	• Considering (initial) costs • and future operation • Reduction of maintenance costs through involvement by teachers, parents, students • Use of solar energy • Buying small trees if none are present	• Possibility for additions/expansion • Vehicular acess • Cost reduction through user involvement in planning; avoidance of planning mistakes • Energy conservation concepts • Mechanical ventilation as needed to increase well-being • Increased thermal insulation → long-term cost savings • Vandalism • Appropriateness for community use for recreational and wellness needs • Accessibility for people of all ages	• Multi-functionality appropriateness for exhibits • Thermal insulation	• Energy conservation • Utilization of natural (air) temperature • Color design with 'warm' and 'cool' colors • Up-to-date climate control, possibility of individual (manual) control • Cross-ventilation • Mechanical climate control (expensive but necessary) • Use of day light (,free' resource) • Prevent planning mistakes through user participation • Involving students in maintenance	• Energy-conserving construction • Using color scheme for effect of rooms	• Energy-conserving construction • Thermal insulation • Considering future operational costs	• Involving students in maintenance • Cost saving provisions? • Accessible shared public spaces

8 Conclusion: What Makes a School a “School of the Future”?

Rotraut Walden

This chapter is a summary of recommendations on building and renovating “schools for the future” that are stated throughout this book. These recommendations have been systematically compiled by means of the facet approach and the system for judging the quality of buildings (see chapter 7). This is a specific method of architectural psychology and social sciences. The sources of the data were: Historical experiences with school buildings (see chapter 2), results of architectural psychology research (see chapter 3), interviews of architects of innovative school buildings (see chapter 7), observations by architectural experts who are building schools and teaching in the United States and Japan (the authors of chapters 4–6) as well as descriptions of innovative school projects (see Appendix). The fact that the book presents mainly material from architectural psychology research and innovative architects is a specific approach of environment-behavior research. Further architectural psychology studies (Walden, 2007) look at student and teacher responses, that is, users. These studies capture the effects of architecture upon performance, wellbeing, environmental control, and social interaction, quantitatively, by means of the Koblenz Architecture Questionnaire. One result of these studies supports the assumption of this book that the effects of good design are improved feelings of wellbeing and social interaction, which in turn are related to higher assessments of performance. This means that the question raised for architecture by the PISA studies, whether better buildings result in better performance, is, in our opinion, being answered in the affirmative (cf. Gifford, 2002). “The ‘third teacher’ besides the educator and the fellow student is the school building” (Swedish saying). ”

In future, more interviews with representatives of parents, teachers, and students are planned. One excuse for not already including more user responses is the consideration that we interviewed architects who look at “design as a social process” (Blundell Jones about Peter Hübner, 2007; see also Sanoff, 2001a, 2001b, 2002) and therefore already not only talked with users but worked with them

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in designing and building schools. In all of this, the architectural psychologist is concerned with the relationship between the building and user experience and behavior. Really innovative schools have not yet been built but remain a vision in the minds of architects and users. Here, we attempted to look into the minds of architects to get a slight idea of that vision. Looking into the minds of users is a future task, which we are getting ready to confront. That users' vision will be a mirror for the intentions of the architects, showing us whether the architects' visions have succeeded from the point of view of the users.

8.1. General Recommendations for School Building and Environment

Some recommendations seem obvious but, unfortunately, they are often necessary reminders on how to meet standards that should be matter-of-course in all school construction. These requirements are:

- Adequate space for the number of students enrolled
- Environmental conditions that are safe and appropriate for learning (protection from weather, temperature regulation, ventilation, natural lighting, minimal air pollution from external and internal sources like emissions from building materials, pleasant acoustics, ergonomic furniture and technological equipment for instruction)
- Facilities and equipment that are now considered essential parts of proper educational environments (science and special project rooms, a library, a cafeteria, exercise and sports facilities, playgrounds, exhibit areas, and recycling facilities)
- Use of durable, easily maintained building materials
- Integration of residential parts of the communities with the schools served
- Easy access and operation of all areas by users with various disabilities and developmental levels
- Observation of regulations on safe construction and operation.

Beyond these matter-of-course concerns, the authors of this book urge the adoption of various goals for schools of the future that are not as commonly recognized. These goals are derived from the premise that schools should be places for both learning and living and should, therefore, be designed with an emphasis on livability and atmosphere. Above all, school design should cater to the wishes of students and teachers in order to achieve a "sense of home." It is important for students, teachers, parents (and community members) to:

- participate in the design and construction processes;
- take responsibility for their environment;
- socially interact, use teamwork, creativity and problem solving skills;
- view the school as a space for the entire community that can be used during afterschool hours; and
- understand that investments in schools and children are investments in the future of society.

When users participate in the beautification of schools, they develop a sense of responsibility for the space. Vandalism in the more than 40,000 schools of Germany causes 50 million euros worth of damage annually. Stoner, Shinn, and Walker (1991; see Goldstein, 1996) estimate that the annual cost of school vandalism in America's approximately 84,000 schools amounted to 600 million dollars in 1990. Instances of vandalism, however, can be reduced through architectural-psychological provisions: Giving users the opportunity to design their own immediate environment, the responsibility for cleanliness and maintenance and by granting key access to buildings for responsible students and parents. A connection must be made between users' acceptance of and control over their environment and their feeling of "being at home" in order for students, teachers, parents, and community members to take full advantage of what the school environment has to offer (cf. Gifford, 2002, pp. 324 et seqq.).

Outlined below are planning and design recommendations for seven specific areas of a school: The site, building, entrance, classrooms, special and multipurpose rooms, interior features such as stairways and halls, and the school yard. These recommendations are not prescriptions for guaranteed success because, in analyzing interviews conducted for this book, one is not dealing with causal relationships but rather with descriptions of specific (but not exclusive) solutions to problems. This compilation of recommendations ultimately addresses the question: What are the innovative and unfavorable aspects of school design that must be considered in creating a school of the future?

Site

Innovative (+) and/or unfavorable (–) aspects:

+ Involvement of the architect in site selection.
+ Safe access to the school for all modes of transportation: Pedestrian, bus, mass transportation (where applicable), cars and bicycles; these various transportation modes should cross paths as little as possible.
+ Demarcation of the site (with a fence or hedges) to protect students from dangerous traffic and crime; teachers should be able to easily supervise playground activity from school windows.
– Exposure to noise and pollution from nearby heavy traffic arteries or industry.
– Unsafe dropoff areas.
– Excluding users in site selection and landscape design.

The School Building

Innovative (+) and/or unfavorable (–) aspects:

+ Design that facilitates innovative teaching methods (i.e., IT-based).
+ Adequate natural lighting in all parts of the school.
+ Pleasant acoustics, ventilation and air-conditioning systems that offer adequate temperature regulation while not being too costly.
+ Design that facilitates community access and after-hour use.
+ Organization of the structure that facilitates orientation and way-finding through signage and identification of various building parts through differentiation of shapes, materials, colors, or other symbols.
– Excessively large school buildings; smaller “school houses” for individual classes or other small groups are preferable.
– Spaces that lack flexibility, with low ceilings and poor lighting.
– Saving on costs of construction materials if it might mean endangering users’ health.

The Entrance Area

Innovative (+) and/or unfavorable (–) aspects:

+ Pick-up and drop-off areas that are safe and protected; teachers should have clear views from inside the school building to supervise children.
+ Traffic paths and ramps adequate for people with disabilities.
+ Easily visibility, easy access and orientation to the various parts of the school complex.
+ An entrance area that serves as a meeting place and offers space and seating for waiting, lingering.

- + Doors and other architectural elements that prevent wasting energy through loss of heated / cooled air.
- + Opportunities for exhibiting student work.
- + Provision of adequate trash and recycling containers.
- + Good vehicular access for emergency vehicles (ambulances, fire trucks).
- – Exposure to rain, sun, and excessive wind and draft.
- – An entrance that is too small and not centrally located.
- – Insufficient signage.

Classrooms
Innovative (+) and/or unfavorable (–) aspects:
- + Floor plan of classrooms suitable to various instructional methods (not only lecture style).
- + Opportunities for small group learning and individual study enabled by the kind of furniture selected (easy to move and rearrange), different work surfaces, niches, separate spaces, side rooms, and room dividers.
- + Stimulation of all senses, without becoming distracting.
- + Good environmental conditions: Adequate, glare-free lighting, good acoustics and protection from outside noise, thermal control.
- + Views of outdoors (nature) as well as hallways connecting to other classes.
- + Areas for retreat and individual privacy.
- + Classroom design that invites decoration, embellishment, and rearrangement by users (for example, with shelves, exhibit areas and surfaces, flower beds)
- + Consideration of the possibility for students to help build their own classroom (with adjacent facilities) (see Hübner, 2005).
- – Dark spaces with inadequate daylight.
- – An inflexible (fixed) blackboard.
- – Spaces that only allow for lecture-style discussion.
- – Lack of separate niches that lead to conflict between different user activities (for example, singing and concentrated study).
- – Careless detailing, clashing colors, and inadequate student-designated storage.

Special and Multipurpose Rooms
Innovative (+) and/or unfavorable (–) aspects:
- + Well placed (not situated in remote parts of the complex).
- + Multifunctionality and opportunity for user “appropriation” through movable furniture and appropriate floor plan.

+ Common spaces such as the cafeteria and assembly rooms are friendly and homelike, with good acoustics and ergonomic furniture.
+ Availability for community use after hours.
+ Galleries and exhibit areas allowing for display of ongoing projects.
+ Common spaces with outlets and technology for networking and Internet access, wired or wireless.
+ Adequate storage space for technical and other equipment as well as for archival storage of student work.
– Lack of multifunctionality.
– Located too far from classrooms, which keeps teachers and students from taking advantage of the space.

Interior Design –Hallways, Stairways
Innovative (+) and/or unfavorable (–) aspects:
+ Way-finding clarity.
+ Niches for lingering, meeting and informal interaction.
+ Natural light, greenery, and opportunities for user-provided decoration and design.
– Inadequate containers for trash disposal and recycling.
– Hallways that are too long and narrow and not multifunctional.

The School Yard and Special Outdoor Areas
Innovative (+) and/or unfavorable (–) aspects:
+ School yards designed for and equipped with an adequate number of activities for learning and playing.
+ Different zones for different activity types.
+ Demarcation between zones that flow and consists of greenery (bushes, planting, and hedges).
+ Covered areas for breaks as well as for outdoor instruction.
+ Supervision can be done easily and unobtrusively (for example, by means of view from teachers’ lounge) for protection against bullying and crime, but also provides opportunities for retreat and privacy.
– Inadequate trash separation/recycling.
– Spaces too small to offer a varied range of possibilities for recreation and other activities.
– Lack of security against accidents or criminal activity.
– Inadequate rainwater collection and drainage.
– Insufficient greenery and opportunities for creating gardens.

8.2 Summary

We would like to emphasize that the aim of these recommendations is not so much to increase performance as it is to make proper use of resources that are naturally present when the environment is well designed. Innovative schools should then naturally improve social atmosphere, sense of well-being and, in the end, performance.

What Are the Worst Mistakes that Can Be Made in School Construction?

- Oversized buildings that create a sense anonymity.
- Inadequate protection from criminal activity, bullying, and accidents because of impeded supervision and unsafe passages, stairways or play equipment.
- Buildings too small to provide opportunities for a variety of activities.
- Inadequate passages between the entrance and classrooms.
- Waste of energy because of drafts and inadequate thermal insulation.
- Dark hallways and spaces that require constant artificial illumination.
- Low ceilings.
- Classrooms too small in size.
- Not enough learning materials for the number of students present.
- Design that favors only one teaching method, such as lecture style or recitation.
- Common facilities for students and teachers that lack technical equipment, ergonomic furniture.
- Cramped administrative facilities.
- Lack of noise protection.
- Inadequate facilities for users with disabilities: Missing ramps, handrails, automatic door openers, etc.
- Poor maintenance and service, which can lead to increased vandalism.
- Dirty areas because of hard-to-clean materials and lack of trash collection equipment;

In summary, schools of the future should take the experiences of students and teachers into consideration as their buildings and outdoors spaces are planned. These schools should have a lively design that radiates a friendly atmosphere. Self-designed, beautiful, and friendly schools create an increased feeling of responsibility for the environment, improved creativity, and environmental intelligence in the user as well as causing a decrease in vandalism.

What Should Be Considered in the Planning of Innovative Schools?

- The right for all users to be involved in planning decisions.
- Clear orientation in the entrance and throughout the building.
- Allowance of after-hours use of the building by the entire community.
- Spaces that adapt well to various teaching and learning styles, such as hands-on, project-based learning, team teaching, presentations, and small group instruction, through open and closed plan classrooms and quiet rooms.
- Segmentation of the overall school complex into units ("school houses") of a maximum of 160 students each for every grade level, with small numbers of students per classroom.
- Segmentation of rooms for various teaching methods; an L-shaped floor plan with small side rooms, for example (see chapter 4).
- Learning studios, suites and community spaces for 150–160 students of all ages that facilitate social and emotional learning (see chapter 6).
- Use of IT, LAN, and wireless connections in all parts of the school, which would exist alongside various spaces that foster face-to-face communication (see chapter 5).
- Spaces for individual learning and covered, outdoor spaces.
- Use of environmentally friendly, sustainable, durable and easily maintained building materials.
- Ability for the user to control lighting, glare, ventilation, temperature, and acoustics as a supplement to sensor-based automatic regulation technology.
- Natural, glare-free lighting.
- Flexibility and multifunctionality of spaces.
- Design of classrooms and hallways that provides the possibility for private retreat.
- Opportunities for teachers' privacy; spacious teacher workrooms with space dividers, group workspaces (especially for all-day schools).
- Accident-proof playground equipment in the schoolyard.
- Creating an environment that stimulates all the senses (Kükelhaus, 1971, 1988).

The relationship between design and sustainable living in spaces for learning is currently the subject of intense discussion worldwide. Environmental competence – the ability to create something innovative that simultaneously works within the realm of environmental sustainability – is the issue being examined (Buddensiek, 2001; Engel & Dahlmann, 2001; Dudek, 2000, 2007; Gifford, 2002; Kroner, 1994; Rittelmeyer, 2007, 2013; Schavan, 2001; Watschinger & Kühebacher, 2007; Seydel, 2004).

Innovative architects do not look upon the participation of students, teachers, parents, and the community as something unimportant to the design process. Rather, the participation of these individuals is central to the architects' agenda (Sanoff, 2002, see also chapter 4; Hübner & Beierlorzer, 2005). This is manifested in the architects' choice of words: They talk about the child as the "addressee," about instruction as the "soul" of the building, about the joy of learning, the eagerness to achieve and about the users' sense of being at home.

The architects who were interviewed made it clear that certain cornerstones of their work on schools will continue in the future:

- Flexibility of spaces.
- Relaxed social structure and easy social integration.
- Design for variable instruction methods.
- Students' ability to interact with the community.
- Stimulating environment.

All these elements are combined with other features of design: Easy orientation, inviting spaces, pleasant meeting spaces and niches, separate rooms, seating areas, assembly rooms and meeting halls, smooth transitions between hallways, entrance areas, school yards and other outdoor areas, playgrounds, lawns and hedges, shrubberies, trees, and ponds.

8.3 The Outlook for Schools of the Future

The German Federal Government intends to invest 4 billion euros into a program for the "future of education and child care." Its main objective is to construct new all-day schools. Around 10,000 schools were expected to be converted into all-day schools by 2007. By April 2007, 5,600 such new schools had been created. Schools like as the Protestant Comprehensive School in Gelsenkirchen and the Hundertwasser-revamped Martin Luther High School in Wittenberg demonstrate that "feel-good" schools do not have to be expensive. Costs can be minimized through the contribution of students, teachers, and parents, with provisions for energy-conservation and by performing preventative measures against vandalism.

Architect Peter Hübner calculated that his very livable and creativity-inspiring schools cost 10–20% less than the average school. Schools with modern information technology and sophisticated environmental control systems admittedly cost more money, because they tend to require frequent repair and renovation. As first steps toward creating a feeling of well-being for school users, even the simplest of renovations, such as new paint and decorations, can make a difference. What is certain: Investments in children are investments in the future of a country.

Older schools, including those in areas with decreasing student populations, can be turned into livable, schools/community centers that offer activities and meeting opportunities for youths and their families in the afternoons and evenings. It is also possible to convert such schools into buildings with entirely new functions. The Comprehensive School in Brühl, for example, has been designed so that it can later be turned into a residential center for seniors.

To conclude, here is a declaration made by innovative architects that deserves emphasis: "We can contribute significantly to the goal of applying meaningful design to schools. We cannot, however, create a school for the future by ourselves. The real actors are the students, educators and reformers." The architects thoughtfully add: "School is about independent growth as well as proactive support, and it is characterized by both continuity and adventure."

References

Blundell Jones, P. (2007). Peter Hübner: Architecture as social process. Stuttgart: Edition Axel Menges.

Buddensiek, W. (2001). Zukunftsfähiges Lernen in Häusern des Lernens [Future-oriented learning in houses of learning[. Göttingen: Werkstatt.

Dudek, M. (2000). Architecture of schools. The new learning environments. Oxford: Architectural Press.

Dudek, M. (2007). Schools and kindergartens: A design manual. Basel: Birkhäuser.

Engel, O., & Dahlmann, J. (2001). Pädagogische Architektur [Educational Architecture]. Unpublished thesis submitted to the State Examination Office for First State Examinations at Schools in Cologne as part of the first state examination for special needs education. University of Cologne, Germany.

Gifford, R. (2002). Educational environmental psychology. In: Environmental psychology. principles and practice (3rd ed.). (pp. 296–336). Colville, WA: Optimal Environments.

Goldstein, A.P. (1996). The psychology of vandalism. New York: Plenum.

Hübner, P., & Beierlorzer, H. (2005). Kinder bauen ihre Schule. Evangelische Gesamtschule Gelsenkirchen. [Children build their school: The Protestant Comprehensive School in Gelsenkirchen.] Stuttgart: Karl Krämer.

Hübner, P. (2005). Kinder bauen ihre Schule. Children make their school. Evangelische Gesamtschule Gelsenkirchen. Stuttgart/London: Edition Axel Menges. (English and German).

Kroner, W. (1994). Architektur für Kinder = Architecture for children. Stuttgart: Krämer (English and German).

Kükelhaus, H. (1971). Organismus und Technik. Gegen die Zerstörung der menschlichen Wahrnehmung [Organism and technology. Against the destruction of human perception]. Frankfurt am Main: Fischer.

Kükelhaus, H. (1988). Unmenschliche Architektur: Von der Tierfabrik zur Lernanstalt [Inhuman architecture: From animal factory to learning institution] (6th ed.). Cologne: Gaia.

Rittelmeyer, C. (2007). Schule als gestalteter Raum: Schularchitektur [School as designed space: school architecture]. In S. Hellekamps, W. Wittenbruch & W. Plöger (Ed.): Handbuch Schule [Handbook for Schools]. Paderborn: Schöningh.

Rittelmeyer, C. (2013). Einführung in die Gestaltung von Schulbauten. [Introduction into the design of school buildings]. Frammersbach: Verlag Farbe und Gesundheit.

Sanoff, H. (2001a). School building assessment methods. Washington, DC: National Clearinghouse for Educational Facilities.

Sanoff, H. (2001b). A visioning process for designing responsive schools. Washington, DC: National Clearinghouse for Educational Facilities.

Sanoff, H. (2002). Schools designed with community participation. Washington, DC: National Clearinghouse for Educational Facilities.

Schavan, A. (2001). Schulen in Baden-Württemberg. Moderne und historische Bauten zwischen Rhein, Neckar und Bodensee [Schools in Baden-Württemberg. Modern and historical buildings between the Rhine, Neckar, and Lake Constance]. Stuttgart: Hohenheim-Verl.

Seydel, O. (2004). Die gute Schule der Zukunft [The good school for the future]. In Wüstenrot-Stiftung (Ed.), Schulen in Deutschland: Neubau und Revitalisierung [Schools in Germany: New construction and renovation] (pp. 122–141). Stuttgart: Krämer.

Stoner, G., Shinn, M.R., & Walker, H.M. (1991). Interventions for achievement and behavior problems. Washington, DC: National Association of School Psychologists.

Walden, R. (2008). Architekturpsychologie: Schule, Hochschule und Bürogebäude der Zukunft [Architectural psychology: School, university and office building of the future]. Lengerich: Pabst Science Publishers.

Watschinger, J., & Kühebacher, J. (Eds.). (2007). Schularchitektur und neue Lernkultur. Neues Lernen – Neue Räume [School architecture and new learning culture. New learning – new spaces). Bern: h.e.p./Ott.

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Henry Sanoff, AIA, Professor Emeritus, College of Design, North Carolina State University, has been a lecturer at more than 80 institutions in the USA, Australia, Brazil, China, Denmark, Egypt, England, France, Germany, Greece, Hong Kong, Israel, Italy, Japan, Korea, Mexico, New Zealand, Poland, South Africa, Sweden, Switzerland, and Turkey. He is widely published and well known for his numerous books – including *Community participation in design and planning, School design, Creating environments for young children, Integrating programming evaluation and participation in design, Design games, and Methods of architectural programming.* He won a design award and a post-occupancy evaluation award for the Davidson School, the Millis Elementary School, and the Laguna Head Start Center from the School Construction News/Design Share Awards program. He is the principal founder of the Environmental Design Research Association (EDRA) and USA editor of Design Studies.

Dr. Kaname Yanagisawa is an architect and an associate professor at Chiba University, Japan. He specializes in environmental-behavioral design and facility programming and planning, particularly for educational facilities. He has visited many schools in the USA, Denmark, Finland, Sweden, Italy, Germany, France, The Netherlands, the UK, Singapore, and Taiwan. He has authored numerous publications about school design, universal design, and environmental-behavioral design. He also has written for several architectural and educational journals. He has been planner and advisor in charge of designing and planning innovative schools throughout Japan, including the Gunma International Academy illustrated in this book. He has presented his research and projects at many conferences such as those of the School Building Association (CEFPI), EDRA, and IAPS, in addition to Japanese conferences. In 1994, he received the award of the Architectural Institute of Japan for the research project entitled "Studies on the spatial analysis from the viewpoint of children's behavior setting."

Peter Hübner began his career as an orthopaedic shoemaker. In the 1970s, he became a successful designer of prefabricated buildings and sanitary units. In 1972, he founded his first architectural office together with Frank Huster. This expertise gained him a chair in building construction at the Technical University in Stuttgart, Germany, from which he retired in 2007. Since 1980, his architectural office became more and more experienced with self-help projects. Peter Hübner moved on from small local projects to building a number of projects across Germany, managing to maintain a strong participative component even in ventures that started as competition designs. The most outstanding of these is the Evangelische Gesamtschule (Protestant Comprehensive School) in Gelsenkirchen

(1993–2004), with a strong ecological theme. An even more recent project for the reconstruction of the Dutch town of Enschede shows how the participative method can be employed to generate a genuinely complex townscape reflecting the needs and wishes of its inhabitants, in the way old towns grew spontaneously without the imposition of a master plan. We are grateful for the assistance of Professor Hübner and his firm plus+ bauplanung GmbH who constructed the Justus-von-Liebig School as well as Helga Giesen of the city of Moers/ Germany – and principal Claudia Corell.

Translator

Chapters 1, 2.3, 3, 7, and 8 were translated from the German by Thorbjoern Mann, Dipl.-Ing. (Arch.) Technical University of Munich, M.Arch. and PhD (Arch.) University of California, Berkeley, CA, Professor Emeritus at Florida A&M University School of Architecture, Tallahassee, FL, USA where he has been teaching architectural design, design methods, architectural programming, building economics, and time management for designers. His publications include *Building economics for architects, Time management for architects and designers, The Fog Island argument* and numerous papers and presentations on design methods, the role and assessment of arguments in design discourse, occasion and image in architecture, and other topics.

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Rotraut Walden and Simone Schalz, formerly Borrelbach: We would like to thank architect Peter Busmann (Cologne, Germany) very much for spending hours of his precious time with us for our structured interviews and a site visit of the Comprehensive School Brühl South. Without the data from these encounters, to which several other German architects such as Dieter Wendling in Kastellaun made contributions, we would not have been able to carry out this study. Furthermore, we would like to thank Professor Dr. Christian Rittelmeyer, who commented in a personal letter on building requirements like flexibility, on psychological aspects (user well-being), and educational guidelines (school as a place for encounter). The contributions by Friedensreich Hundertwasser (who has passed away in February 2000) and Joram Harel to a written survey were very encouraging. Hundertwasser's publication "Vom schöpferisch Wissenden zum Unwissenden" ("From a creative knowledge to creative ignorance") is provided in the Appendix.

Simone Schalz: I am especially grateful for the time the architects granted me and for the subsequent visits to their school projects as well as for their interest in accompanying me on these visits with educational conversations, which sometimes led to putting off other scheduled appointments. The people I interviewed impressed me with their professional competence and fascinating expertise that carried my investigations forward with valuable information. I learned that continuing education and reflection, initiative, a pioneering spirit, constant search for new learning, and a commitment to a personal touch are all constant challenges for architects.

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Appendix

Descriptions and Photographs of 24 School Examples from 11 Countries on 5 Continents

This section presents 24 innovative schools from 11 different countries on 5 continents, including those discussed in the various chapters. A glance at the case descriptions will complement our view of innovative features of schools of the future. Hardly any of the examples is meet all our expectations simultaneously, but there are many that come close to the ideal. The examples contributed by Henry Sanoff are closest to the concept of participation. Kaname Yanagisawa's schools are especially focused on the requirements of information technology but he also describes how the circumstance of having a zoo nearby was integrated into a school's concept. The schools contributed by Jeffery A. Lackney illuminate the concepts of "learning landscapes," learning suites and communities. The examples described by Rotraut Walden refer to "home-like" schools with innovative ecological concepts; here, schools designed by Peter Hübner should be mentioned, who understands "design as a social process." A very artistic school created with the help of the students is the "Hundertwasser House" of the Luther Melanchthon High School in Wittenberg, described by Simone Schalz. The features of all these schools were integrated into the list of important features for building innovative schools presented in chapters 7 and 8. The vital character of all these school examples demonstrates that not all of the desirable features we listed necessarily have to be met in a given school at the same time. A concept for a school that integrates many of these characteristics and supports clear teaching and learning styles in a given context will be sufficient. Schools of the future are varied!

Photographs of the Comprehensive School Brühl South (case study # 19) courtesy of Markus Freiwald, Hannah Lange, Sandra Rühl, and Daniela Haschke. Photographs of the Protestant Comprehensive School Gelsenkirchen (case study #20) and Photographs of the Justus-von-Liebig School Moers (case study #22) by Cornelia Suhan, courtesy of Peter Hübner. Photographs of the Martin Luther High School and Elementary School Wittenberg (case study #21) courtesy of the school. All other images provided by the authors.

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USA

Case Study #1
Rosa Parks Elementary School, Berkeley, CA, USA
A Community School Designed for Accessibility. Ratcliff Architects. 1997. Kindergarten – 5th grade; 21 teachers, 343 students (Author: Henry Sanoff)

Located in an ethnically diverse area of Berkeley, California, the Rosa Parks Elementary School (formerly the Columbus School) was declared seismically unsafe following the 1989 Loma Prieta earthquake. The Columbus School has been the heart of the West Berkeley community for well over half a century. The decision to close the school after the 1989 earthquake was heartbreak and an opportunity to revitalize the aging center of the community. The Berkeley Unified School District supported the community's vision of creating a model community-oriented urban school. Working closely with the school district, teachers and the community, the architects planned and designed a new K-5 school that provides a preschool, before and after-school childcare programs, a learning resource center for students and parents, and a science center as well as space for family programs, counseling, and healthcare services.

The Rosa Parks Elementary School was the result of a long inclusive community planning process, which fostered the design of a human place, but also had an impact on the community. Children and families can take advantage of various community services at the school, including health and counseling services, and after-school activities. Community use of the facilities includes a multi-purpose room for public meetings, rehearsals of the Berkeley Symphony Orchestra, and celebrations and performances. The community's collaboration with the architects resulted in a place whose design fosters community connectedness and social goals.

The Rosa Parks School won the Places/ EDRA design award for demonstrating the connections between good participation, good design, and good consequences (Bressi, 2000).

Case Study #2

Davidson Elementary School, NC, USA

Adams Group Architects and Henry Sanoff AIA. 1994.

Kindergarten – 5th grade; originally 600 students, now 960 students, 42 teachers Initially 77,000 sq.ft., now 94,000 sq.ft. (Author: Henry Sanoff)

The Davidson Elementary School project links all stages of the school building process, from user participation in the development of the program to the evolving design solution, and a building evaluation after completion. Although this project required several visits after construction to complete, the knowledge gained from the post-occupancy evaluation (POE) reinforced the effectiveness of the participation process in improving the quality of education.

Case Study #3
The School of Environmental Studies, Apple Valley, MN, USA
Bruce Jilk, H.G.A. Architects. 1995.
11th–12th grade; 400 students (Author: Kaname Yanagisawa)

This school was built in the Minneapolis-St. Paul suburb with the goal of integrating traditional disciplines within the context of studying the environment. This school is also known as the "zoo school" because of its active partnership with the Minnesota Zoo. The school embraces project-based learning with an environmental theme. Students are grouped into 4 houses of 110 pupils with 3 or 4 teachers each who are teamed up. Each house, on the second floor of the building, has a science classroom, a shared teachers' office, a common space, and student workstations. The workstations are composed of 10 pods with 10 pupils each, and are intended as a place for individual work and personal activities. The common space is used for team learning and presentations. There is a community area on the first floor which includes a forum, library/media center, and several laboratories. The forum, with large windows offering a view to outside nature, is used as a cafeteria, auditorium, and display center. The school has a large quantity of IT equipment such as computers, videos, and audios in the houses, labs, and hall for promoting student individual learning (see New Design for Learning, 1999: The School of Environmental Studies Design, impact report No. 1. Independent School District 196). 216

Case Study #4

Crosswinds Arts and Science Middle School, Woodbury, MN, USA

Cuningham Architects. 2001.
6th–8th grade; 600 students
(Author: Kaname Yanagisawa)

This school operates as a year-round school for 600 students from eleven (originally six) districts with an emphasis on arts and science. Educators, parents, and community members collaborated to create a vision for the school such as hands-on project-based learning and development of presentation and performance skills. The school building is composed of multi-level houses around a central core comprised of a dining and performance space, administration spaces, a media center, and gym. There are six home bases designed for 100 students each. Each house has a variety of spaces to accommodate different learning groups such as individual workstations, small group rooms, project labs, seminar rooms, and resource areas. Individual workstations are grouped by 16 and each owned by a student, and a pair of groups shares a common work area. This variety of spaces enables students to learn individually and also to work with an interdisciplinary team of teachers. The school is located on a natural habitat and wetlands, creating a useful setting for outdoor learning laboratories (see Cuningham Group Architecture. (2002). Crosswinds Arts and Science Middle School, project report. Minneapolis, MN: Cuningham Group Architecture).

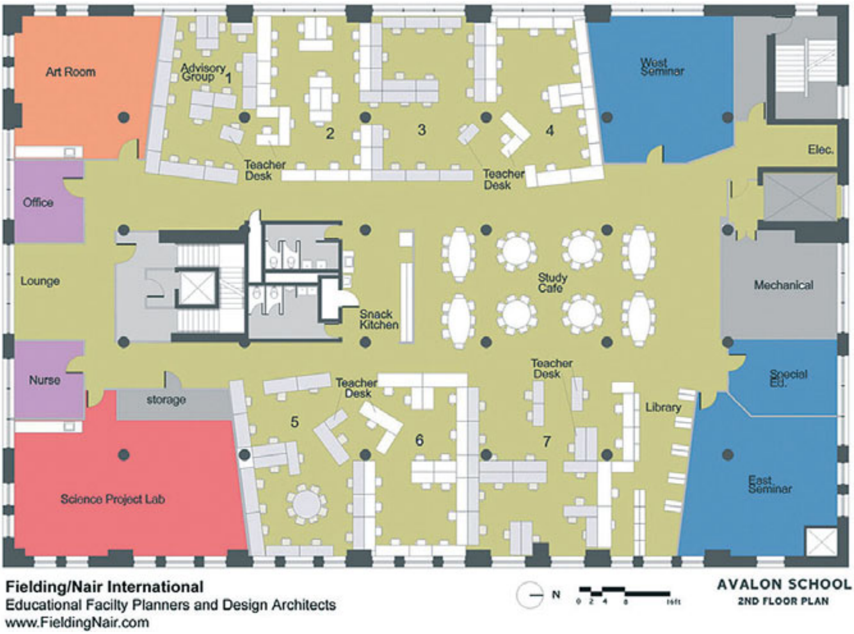
Case Study #5
Harbor City International School, Duluth, MN, USA
Randall Fielding, Scalzo Architects. 2002. (Author: Jeffery A. Lackney)

Harbor City Charter School (high school) is a small school that occupies the third floor of an 19th century industrial building in the central business district of Duluth, Minnesota. It is home to 200 students on two 14,000 square foot floor plates. Harbor City provides a small, learner-directed community encouraging investigative learning and global citizenship and nurtures a sense of belonging. The school's purpose is to graduate students who are knowledgeable, discerning, passionate, creative, and reflective. The school is located within walking distance of the public library, YMCA, art museum, aquarium, and television station – allowing the school to leverage other facilities for learning. Collaboration and project-based learning were identified as key objectives in the planning of this learning environment. The design of Harbor City is intended to support collaborative, project-based learning through the provision of variable sized spaces, individual workspaces, presentation space, "cave" space for concentrated work, spaces with access to food and beverage, process galleries, studios and labs, collaboration incubators, set away spaces or niches, display spaces, and access to technology and a wireless network. Each student has a home base comprised of a lockable drawer, adjacent coat hook and an individual workstation shared with one other student that includes rounded conference ends and an absorptive tack board and partial height enclosure for privacy. A small informal café, rather than a traditional large cafeteria, serves as a social team area, with an adjacent kitchenette. In contrast to the lively, high-volume character of the café, a quiet team area is located at the center of the school. Student workstations, bookcases, and comfortable chair clusters support individual work and small group meetings. Interior windows are used throughout the school to bring light into the interior, as well as to foster connections between adjacent spaces.


Office

Case Study #6
Avalon School, St. Paul, MN, USA
Architects: Fielding/Nair International. 2003. (Author: Jeffery A. Lackney)

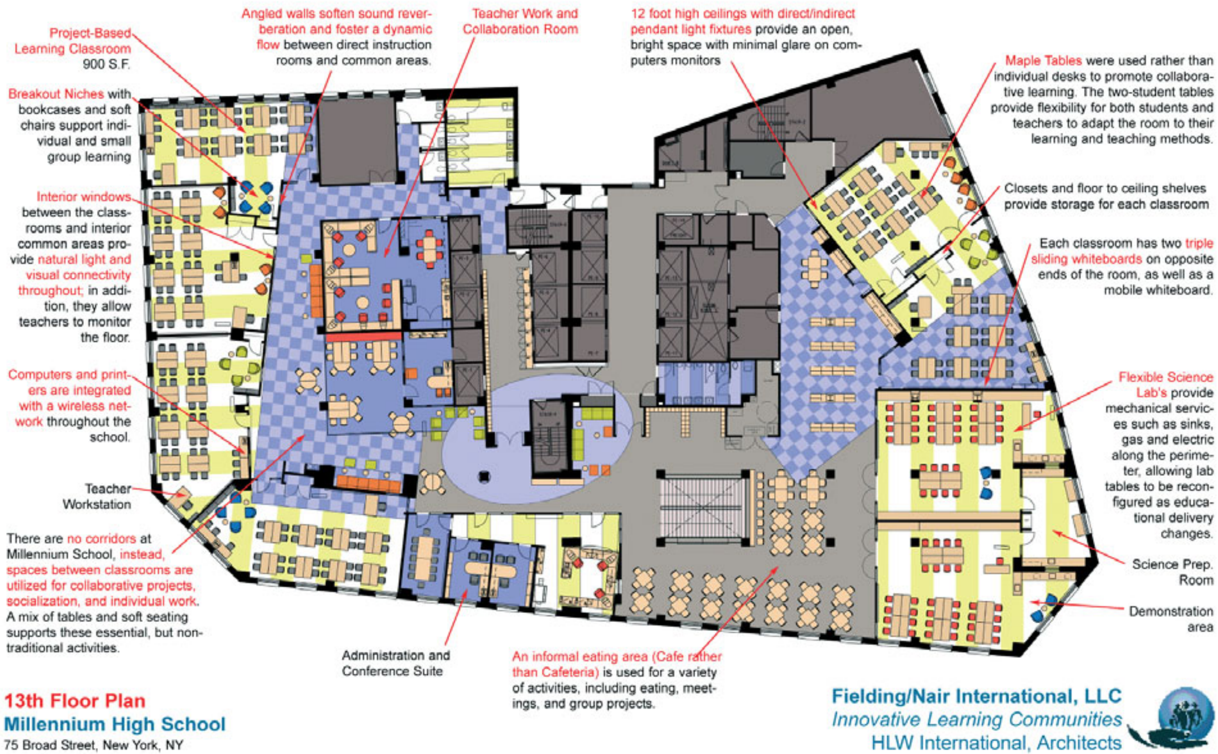
Avalon School is a small charter school located in an existing industrial building in downtown St. Paul, Minnesota, and contains 120 high school students. The school is organized around an advisory structure where 7 advisors work with 17 students each. The curriculum stresses depth over breadth and draws upon the passions and interests of its students. The school is oriented around the humanities with the philosophy of the school centering on the importance of civic life, ideas, equity, and the worth of the individual in a global society. The school draws on a non-teacher community for mentors to identify passions, teach real-life skills, apprenticeships, and contributions to community. Cross-cultural awareness is nurtured through partnerships with schools in other communities and countries. The Circle, where students sit in a circle on the floor of the main gathering space, is used for discussing projects, advisor-led seminars, and resolving student and teacher disputes within the school rather than an overreliance on administrative rules. There are no traditional classes, rather, seminars are created to provide the knowledge required for students to complete their work. There are no grade levels. Instead of progressing through graded levels, students demonstrate mastery in a transparent and integrated list of educational com-



petency standards. Each of the seven advisories contain individual desks and computer workstations for each student. Advisors have desks adjacent to each of the seven advisory areas that surround a central multipurpose space that includes room for a café, kitchenette, group tutoring and individual breakout space.

Case Study # 7
Millennium High School,
New York City, NY, USA
HLW Architects, Fielding/Nair International. 2003.
9th–12th grade; 500 students (Author: Jeffery A. Lackney)

The Millennium High School in New York City is a new 500-student grade 9–12 high school on three floors of an existing commercial office building in downtown Manhattan and part of a broader post-September 11 revitalization of the area. Lower Manhattan provides an opportunity for extending learning into the community full of numerous mentoring opportunities with museums and businesses. A dedicated entrance and separate elevators are provided to maintain the school's identity within the larger commercial building. Each floor consists of two neighborhoods for each grade. An interconnecting stair joins the three floors and serves as a vertical gathering space and informal presentation area. At street level, a community room for 200 people with state-of-the-art audio/ visual capabilities and an art gallery are planned. Millennium High School espouses a constructivist philosophy offering an integrated, interdisciplinary curriculum that provides students with opportunities to create personalized learning experiences based on their own goals and interests. The school design responds to this curriculum by affording a variety of interconnected small-scaled learning settings. The key, animating feature of the school design is the organization of each neighborhood floor plate. Replacing the traditional corridor design of most factory model schools are a series of interconnected spaces outside classrooms that form flexible, daylit project areas with comfortable, flexible furnishings with a wireless network. The flexible arrangement of space outside the classrooms provides support to a variety of neighborhood activities from advisory group meetings to peer tutoring and informal social activities. Classroom spaces as well offer an independent reading and studying area as well as tables on castors that allow for rapid and flexible rearrangement of space for teaming and other activities.


Project-Based Learning Classroom 900 S.F.
Breakout Niches with bookcases and soft chairs support individual and small group learning
Interior windows between the classrooms and interior common areas provide natural light and visual connectivity throughout; in addition, they allow teachers to monitor the floor.
Computers and printers are integrated with a wireless network throughout the school.
Teacher Workstation
There are no corridors at Millennium School, instead, spaces between classrooms are utilized for collaborative projects, socialization, and individual work. A mix of tables and soft seating supports these essential, but non-traditional activities.
Angled walls soften sound reverberation and foster a dynamic flow between direct instruction rooms and common areas.
Teacher Work and Collaboration Room
12 foot high ceilings with direct/indirect pendant light fixtures provide an open, bright space with minimal glare on computers monitors
Maple Tables were used rather than individual desks to promote collaborative learning. The two-student tables provide flexibility for both students and teachers to adapt the room to their learning and teaching methods.
Closets and floor to ceiling shelves provide storage for each classroom
Each classroom has two triple sliding whiteboards on opposite ends of the room, as well as a mobile whiteboard.
Flexible Science Lab's provide mechanical services such as sinks, gas and electric along the perimeter, allowing lab tables to be reconfigured as educational delivery changes.
Science Prep. Room
Demonstration area
Administration and Conference Suite
An informal eating area (Cafe rather than Cafeteria) is used for a variety of activities, including eating, meetings, and group projects.
13th Floor Plan
Millennium High School
75 Broad Street, New York, NY
Fielding/Nair International, LLC
Innovative Learning Communities
HLW International, Architects

Asia

Case Study #8
Akemi Minami Elementary School and Akemi Middle School, Urayasu, Chiba, Japan
Architects: INA, Planning Advisor: Kaname Yanagisawa. 2005.
1st–9th grade; 960 + 600 students
(Author: Kaname Yanagisawa)

This school was built in a newly developed residential area in the Urayasu bay area. The school is composed of an elementary school, a middle school, and shared facilities. The elementary school and the middle school areas are connected to each other by a spacious hallway called a "community street" for social interaction between elementary and middle school students. The shared facilities area including a gym, library, multi-purpose space, music room, and labs is located in the center for easy access from both the elementary school and the middle school. This area is assumed to be used by the community as well. Regular classrooms in each grade are grouped in cluster units. There are various learning spaces besides regular classrooms in each unit, such as a science & art room, students' lounge, teachers' workstation, common work area, reading area, quiet room called "den," wet corner, and computer center. There is a wide wooden deck in front of classrooms for outdoor activities. These spaces are designed to encourage individual learning and social interaction.

Case Study # 9

Gunma International Academy, Ohta, Gunma, Japan

Architect: CAt + CAn, Planning Advisors: Jun Ueno and Kaname Yanagisawa. 2005.

1st–9th grade; 970 students

(Author: Kaname Yanagisawa)

Gunma International Academy in Ohta city introduces "immersion education," which uses English native teachers and Japanese teachers to teach subjects in English as a team. Ohta city is authorized as a special educational ward by the national government as a way to establish this unique school. Students from 6 to 15 years old study every subject in English, except Japanese language classes and social science classes. The school building is specially designed to correspond to this unique educational system by grouping every three grades in "neighborhoods." Every "neighborhood" has three units called "houses" with 100 pupils in the same grade. Each "house" has a closed classroom, an open classroom, an art and science area, three home bases, a quiet room, and a teacher station. The school is a one-story wooden building with many courtyards used for both learning and playing. Besides English-based learning and team teaching, the school also focuses on individual and diversified learning using IT. There are many computers, not only in the media center, but also in each house's common spaces and quiet rooms. There are also various social places inside and outside of the school. (see CAn+CAt. (2005). Gunma Kokusai Academy. Shinkenchiku, vol. 80, pp. 125–134. Tokyo: Shinkenchiku, Inc.).

Case Study #10

Pathways World School, Gurgaon, New Delhi, India

Architects: C. P. Kukreja & Associates and Prakash Nair. 2003.

Kindergarten – 12th grade; 1,150 students

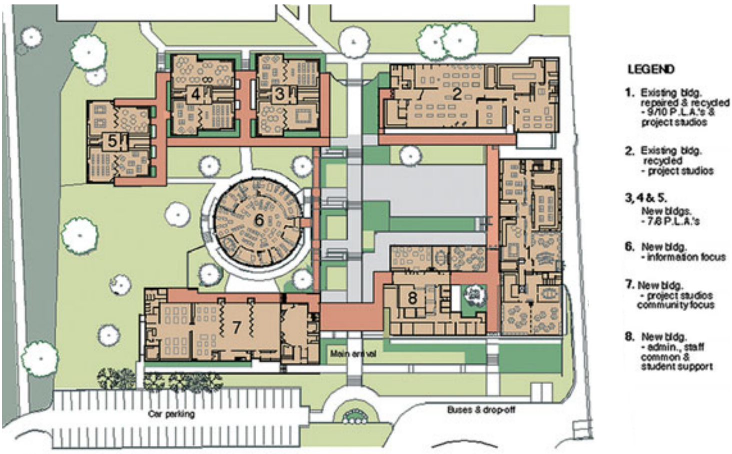
(Author: Jeffery A. Lackney)

The Pathways World School is a grades K-12 school for 1,150 students on 30 scenic acres in the Aravili Hills near New Delhi. It provided an opportunity to respect the inevitable forces of globalization that are breaking down nationalistic and communalistic boundaries and to marry centuries' old Eastern education philosophies with the rigor and structure of the western education model. The name of the school, Pathways, represents the multiple pathways to learning that are available and how each individual walks a different pathway of learning during the course of his or her life. A "Learning Street," a Western notion borrowed from "Main Street," organizes the entire project. The school is planned with the understanding that learning does not begin or end in the classroom. The entire site has been laid out as an eclectic mix of formal and informal areas to encourage different learning styles. Students can have one-on-one lessons from peers or teachers in so-called "formal learning zones" with the immediate area outside the classroom serving as an extension of the learning experience and designed to encourage informal student gatherings that flows into a central green zone within each academic block designated for student-created gardens. Each academic block contains one room set aside as an independent study lounge for students.

Australia

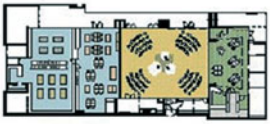
Case Study #11
Reece Community School, Tasmania, Australia
Architects: Glenn Smith Associates, Prakash Nair, and Tasmania Department of Education. 2002.
(Author: Jeffery A. Lackney)

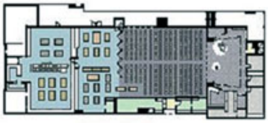
The Reece Community School mission is to instill a love of learning in all students through an integrated project-based curriculum while recognizing and aiming to fulfill the learning needs of all members of the community. The plan for the Reece Campus was built around the creation of discrete 100-student small learning communities. One building on campus was designed in large structural bays specifically to be reconfigured for a variety of learning environments, from a single meeting of 500 people in the entire space to the division into smaller environments for distance learning programs, dance and music programs, and more long-term projects. Classrooms offer wireless computing and provide each student with their own individual workstation with lockable storage to support more independent learning. In addition, the school incorporates a diversity of settings and spaces to reflect different learning modalities of students.

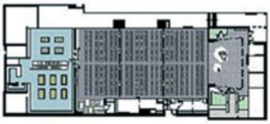


Site Plan


Existing Stair
Prep Room
Science 1
9-10 Work Spaces
group presentation
retractable walls
Passage
visual link
Passage
physical connection
Lobby
Science Project Room
visual connection
25 no. 9-10 work spaces
operable wall
25 no. 9-10 work spaces
flexible project learning areas
Science 2
view to courtyard
Atrium
Project Studio 8
Store
Lift
Interview Room
Staff room
visual control







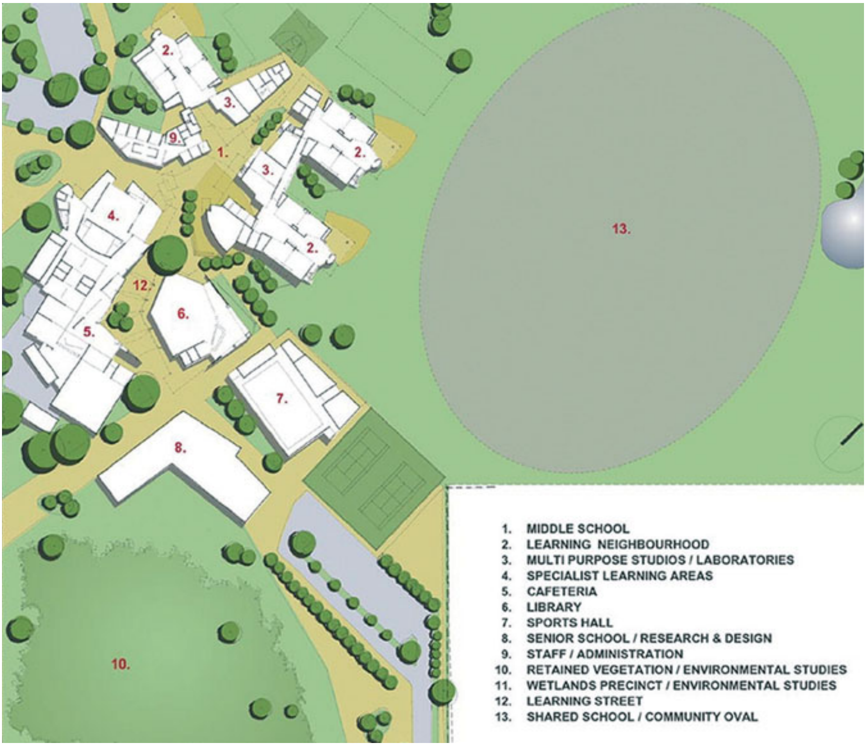

Catering
Food
Project Studio Enterprise
Project Studio Drama
Project Studio Movement
Project Studio Music

Case Study #12

Canning Vale High School,
Perth, Western Australia

Spowers Architects/VITETTA. 2003.
8th–12th grade; 1,200 students
(Author: Jeffery A. Lackney)

The design of Canning Vale was guided by a number of explicit project principles developed by the school's stakeholder community that included personalizing learning, supporting students with adult mentors and peer groups, environmental, project-based authentic learning, workplace learning experiences, and fostering smaller learning communities. The grades 8–12 school is organized in family groupings of 16 students or less, each under the care of an advisor, with eight families making up one neighborhood and five neighborhoods making up the middle school community for a total capacity of 1,200 students in 146,000 square feet. Meeting places for each neighborhood or "corroborees" (aboriginal term for gathering places) have been carefully integrated into the design. A number of unique design elements were provided to encourage "unprogrammed" learning opportunities and cross-curricular collaboration. For instance, the bandstand opens to a learning street and cafeteria zone to allow for impromptu performances, the lecture theatre is flanked by a climbing wall, entrances to neighborhoods are paired with "making and testing" studios that are not curriculum-specific, and eco-gardens and a recreated wetland precinct were developed in collaboration with a local environmental group.


1.
2.
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8.
9.
10.
12.
13.
1. MIDDLE SCHOOL
2. LEARNING NEIGHBOURHOOD
3. MULTI PURPOSE STUDIOS / LABORATORIES
4. SPECIALIST LEARNING AREAS
5. CAFETERIA
6. LIBRARY
7. SPORTS HALL
8. SENIOR SCHOOL / RESEARCH & DESIGN
9. STAFF / ADMINISTRATION
10. RETAINED VEGETATION / ENVIRONMENTAL STUDIES
11. WETLANDS PRECINCT / ENVIRONMENTAL STUDIES
12. LEARNING STREET
13. SHARED SCHOOL / COMMUNITY OVAL

Europe

Case Study #13
Montessori College Oost, Amsterdam, The Netherlands
Architects: Herman Hertzberger. 2000.
6th–10th grade; 1200 pupils
(Author: Kaname Yanagisawa)

This school is a private, prevocational school for over 1,000 pupils. The school is composed of two parts: A five-story classroom tower and a one-story laboratories/gym building. There is a central, skylit open space between these two parts. It is used for lunch, performances, assembly, and artistic activities. According to Montessori's concept, the school focuses on education for individuality by providing various learning and social spaces. The classroom tower has a huge atrium with a five-story height, and various classrooms for accommodating different-sized groups and learning styles. It also has many social and personal spaces such as coffee nooks, lounge, and cloakrooms. Round-shaped wide stairs in the atrium are used for performances, meetings, and individual learning. The education in this school is also very unique in focusing on learning with computers and other IT devices, allowing individuals to work at their preferred place, and offering many optional classes. Even though it is a private school, some facilities are open to the public after school hours (see de Vries, T. (2000, July/August). Montessori College Oost in Amsterdam: Ankerpunten in een verticaale stad [Montessori College East in Amsterdam: Anchors in a vertical city]. Detail in Architectuur, 16–19).

Case Study #14
Futurum Haboskolan, Balsta, Stockholm, Sweden
Architects: Jack Pattison. 1999.
1st–9th grade; 1,018 students
(Author: Kaname Yanagisawa)

This school is located in a newly developed residential area. Students are divided into six working units of around 160 pupils and 16 teachers each. Every working unit has 1st–9th grade students, much like a small, self-contained school. In each unit, teachers with different specialties are teamed to teach and guide students' learning. Students tend to learn individually, following their own curriculum designed with the teacher and their parents. There are various learning spaces in each working unit such as several small classrooms for 5–10 students, a large open classroom, a covered outdoor classroom and a teachers' lounge as well. The large open classroom in the center of the unit is equipped with many computer and other IT devices for individual project-based learning. The main school building is L-shaped with working units along the perimeter, and shared facilities such as the lunchroom, stage, science, music, art, and textile room located in the middle. The library and some labs are in another building and are open to the public after school hours until midnight (see Yanagisawa, K. (2004). Schools in the World, No. 4: School Planning and Design in Sweden. Kenchiku Gahou, vol. 309, pp.114–121. Tokyo: Kenchiku Gahou, Inc.)

Case Study #15

Fredrika Bremer Gymnasiet Förslag (Upper Secondary School), Haninge, Sweden

Architects: Kristian Lindgren Arkitektkontor AB. 2004.
10th–12th grade; 2,000 students (Author: Kaname Yanagisawa)

This is an upper secondary school composed of three academic units: Social sciences, natural sciences, and art/media/nursing. Each unit forming a community of 400–500 pupils is divided into several courses with up to 160 pupils. The new school building was transformed from an old 1970s building unsuitable for new teaching methods, containing features such as low ceiling heights, classrooms lacking variety, dark corridors, and lack of social spaces. There is a large open space with an atrium located in the center of the building that is shared by three units for student assembly and dining. This space also houses the auditorium, library, and special classrooms. Each academic unit has its own administration, various sized classrooms, labs, teachers' lounge, bathroom, and common space. Each unit common space with a variety of desks, chairs, and computers is designed for individual learning and communication. The building is open, flexible, and light with a skylight and courtyard. The materials used in the interior and the exterior are natural and sustainable.

Case Study #16
Torpparinmaen School,
Kaupunki, Helsinki, Finland
Architects: Seppo Hakli. 1999.
1st–9th grade; 410 students
(Author: Kaname Yanagisawa)

This is an educational complex composed of a school, a youth club, and an adult club. The community people can use some shared facilities such as the gym and labs even during school hours. There is an open space with a two-story high atrium called "agora" in the center of the building. It is used for assembly, lunch, and also many community events. Classrooms and labs surround the agora. Glass walls enable classrooms to visually connect with the hallway and agora. The hallway is wide enough to set up individual learning spaces with computers and other learning resources. The agora is also used for various learning activities. Music, science, art, craft, and home science rooms are professionally designed to accommodate members of the community. The building has an oval-shaped plan and is made of reinforced concrete. The exterior wall with wood finish presents a softened facade to the neighborhood (see Ueno, J. (2005). Schools in the World, No. 6: School Planning and Design in Finland. Kenchiku Gahou, vol. 311, pp. 14–121. Tokyo: Kenchiku Gahou, Inc.).

Case Study #17

Great Binfields Primary School, Basingstoke, Hampshire, UK

Architects: Hampshire County Council. 2004.
Kindergarten – 5th grade; 210 students
(Author: Kaname Yanagisawa)

This school is designed for 210 pupils with the possibility of expansion to 420. It has a unit for visually impaired children. The site is located in woodlands and serves as an exciting learning environment for children since the school has a close relationship with the landscape. It has large windows to allow natural light, ventilation, and great views. The environmentally conscious materials used are low maintenance and durable. The classrooms are arranged on the inner edge of a horseshoe-shaped plan. A hall, labs, library, and common space called "shared area" are arranged on the outer edge of the plan. Rooms and spaces are open with few walls connecting each other. The inner courtyard is dry and paved with sculptures to visually connect to outer woodlands. There are many individual learning spaces with IT capacity, such as the shared area, library, and information technology room. Small individual learning and lab areas are also in regular classrooms.

Case Study #18

The Classroom of the Future at Meadlands Primary School, Grey Court Secondary

School, and Strathmore School, Ham, Richmond-upon-Thames, Surrey, UK
Architects: Future Systems. 2005.
(Author: Kaname Yanagisawa)

This is one of the "Classroom of the Future" projects initiated by the national government. Thirty pilot projects by twelve local education authorities were selected and invested in. This new classroom is the creation of innovative learning environments to deliver the best and most effective education with the most advanced technology in the information age. It also has unique architectural features: flexible, organic, and colorful for creating a comfortable and pleasant environment. It is a stand-alone, factory-built prefabricated classroom made of glass-reinforced plastic. The egg-shaped classroom has a toilet, storage, and large space for individual and group learning. The internal space extends to an outside terrace by opening a glass wall. Students can display their work and communicate with each other inside and outside of the classroom by using wireless IT devices. IT is also used for the building technology such as automatic control of air, natural light, and acoustics. Three classrooms were constructed in a primary school, a secondary school, and a school for special needs (see Yanagisawa, K. (2006). School revolution in the UK and classroom of the future project in the 21st century. Facility of education, science, sports, culture, and technology, vol. 22, pp. 88–92. Tokyo: REIF, Inc.; see also Department for Education and Skills (DfES). (2003). Classrooms of the future. London: DfES.)

Case Study #19

Comprehensive School Brühl South, Brühl, Germany

Architects: Peter Busmann & Godfried Haberer/Cologne. 1998.

5th–13th grade; 75 teachers, 730 (5th–10th grade) + 218 (11th–13th grade) students

(Author: Rotraut Walden)

With the additions during the renovation of the existing school, the entire complex has received a unique appearance integrated into its urban context. The overall size is 13,121 square meters. The center of the new building is the "solar house" with its pyramid-shaped top. The planted courtyard of this glass house serves as a hall used for breaks and as circulation hub. The ecological concept emphasizes passive solar heating (example: solar house) as well as natural (non-mechanical) climate control. The organization of the plan follows the school-in-school system. Accordingly, the general instruction classrooms are arranged in groups of four (four-track school), each with associated spaces for section leader and advisory teachers. Throughout the school there are spaces for individual work, group projects, and after-hour activities. The building scheme, both well organized and economical, allows micro additions to the classrooms as well as entire new buildings as macro additions. Ultimately, the building offers the possibility for conversion into a senior citizen's residence should it no longer be required as a school.

Case Study #20

Protestant Comprehensive School, Gelsenkirchen, Germany

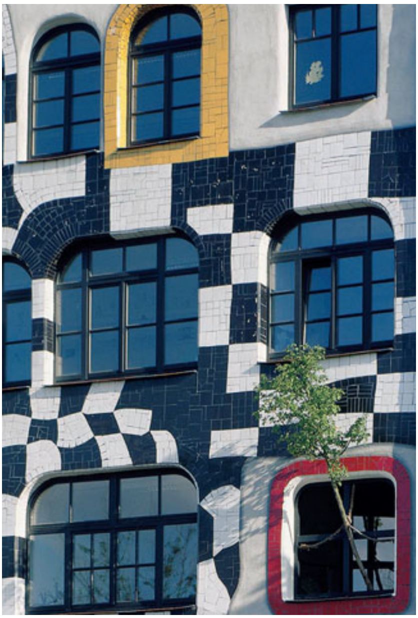
Architect: Peter Hübner. 1998.
5th–13th grade; 80 teachers, 1,100 (5th–10th grade) + 200 (11th–13th grade) students
Net usable floor area: 16,060 square meters
(Author: Rotraut Walden)

Located in a societally critical area of the Ruhr district, this school is conceived much like a small town, with many individual houses for living and learning. It has a generous main building with library, assembly hall, cafeteria, appealing specialty rooms, and a light and airy glass-roofed courtyard with plants that is more reminiscent of a coffee house than a school. These facilities can be used by the residents of the neighborhood. Under the guidance of architect Peter Hübner, the students were allowed to design their own school house for their individual classroom; the first of the children's school house designs have already been translated into construction blueprints and realized. Each unit features not only a class/living room but also a gallery, sanitary installations, and its own entrance. Thirty percent of the students are of Turkish origin, most of them are Muslims.


I'm sorry, I
don't understand!

Case Study #21
Martin Luther High School and Elementary School, Wittenberg, Germany
Architect for remodeling: Friedensreich Hundertwasser. 1999.
(Author: Simone Schalz)

These two schools are located in the middle of a district full of prefabricated housing units in the old Luther city of Wittenberg. The structure was built in 1975 for around 1,400 students (1st–13th grade), and by the 1990s was in need of renovation. During art classes in 1993, some ideas for renovation were generated, which fell in line with the art and architecture of Friedensreich Hundertwasser. The resulting concept is characterized by well-known elements such as moving roof- and facade lines, but also varied facade designs with ceramic elements and multicolored stucco, trees integrated into the structure ("tree tenants"), and conserved parts of the building, which make it possible to recognize the original prefabricated construction. In this way, the old and the new becomes engaged in an exciting dialogue. This school is recognized as a demonstration case for a successful renovation of the school type "Erfurt II," a school model that was built over 550 times in the former German Democratic Republic. Appendix



Case Study #22
Justus-von-Liebig-School in Moers, Germany
Built by plus+ bauplanung;
Architect: Prof. Peter Hübner; plus+ bauplanung GmbH; Hübner-Forster-Hübner-Remes; Free Architects (Author: Claudia Corell, Principal)

Our goal is to support an education toward individual responsible action and holistic development of the personality. The special architecture of our school complex facilitates the optimal living out of this concept. The 'school village' of classroom houses and administration building demands and thereby supports the development of personal responsibility of our students, as well as critical interaction during work, breaks, and after school. The architecture and shape of the buildings and houses emerged from the ideas of students and teachers. This common responsibility resulted in a higher degree of identification with the school. The 'home' of each classroom house will have to be kept clean, designed (decorated, arranged?) and the garden of each class tended to. This is based on students' desire to

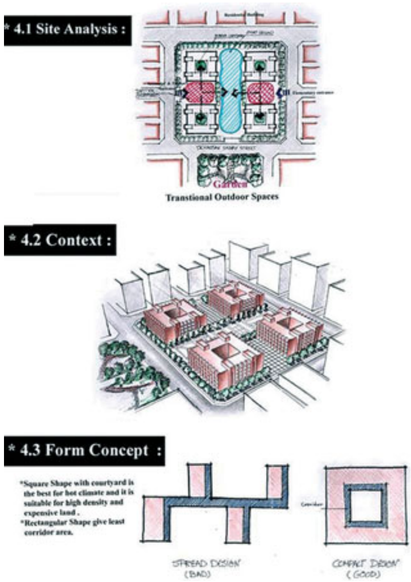
feel comfortable in their own house, without the direction by teachers. In this way, school will become not just a learning institution but a space for living. The classroom houses with gardens and galleries allow differentiates patterns of learning work and phases of free activity, and permit flexible utilization. The furniture of lightweight individual desks makes it easy to achieve different arrangements within the classroom. The gardens can be drawn upon as environmental teaching space and support the method of original encounter that is so important for the natural science education. The classroom galleries facilitate the easy transition between focused attention and relaxation in the instructional process. They also provide retreat spaces. The quality of furnishings which express the expectation of high appreciation is very well recognized by students. The wood construction, supported by the color scheme, creates a special, almost mediterranean atmosphere. Both of these aspects are responsible the fact that vandalism and graffiti defacement of the walls are rare occurrences. The forum functions not only as the place for special events of the school itself, but can be used as a cultural space for the neighborhood. The idea of a school that includes a youth center provides synergy possibilities for the school day as well as for the free after-school activities of our youth. In this way, the school with the youth center becomes a living space for our students. Retreat and relaxation spaces are also provided for teachers in the 'tower room' of the administrative building. The original text of the poster can be found on the application for the Justus-Liebig School for the School Building Prize of the State of North Rhine-Westphalia which this Moers school won in 2013. Photographs by Cornelia Suhan and Prof. Peter Hübner.


Minireferat

Africa

Case Study #23
Manarah School Compound,
Cairo, Egypt
Architect: Educational Projects Co./ Dar Al Omran. 2002.
3,000 students
(Author: Jeffery A. Lackney)

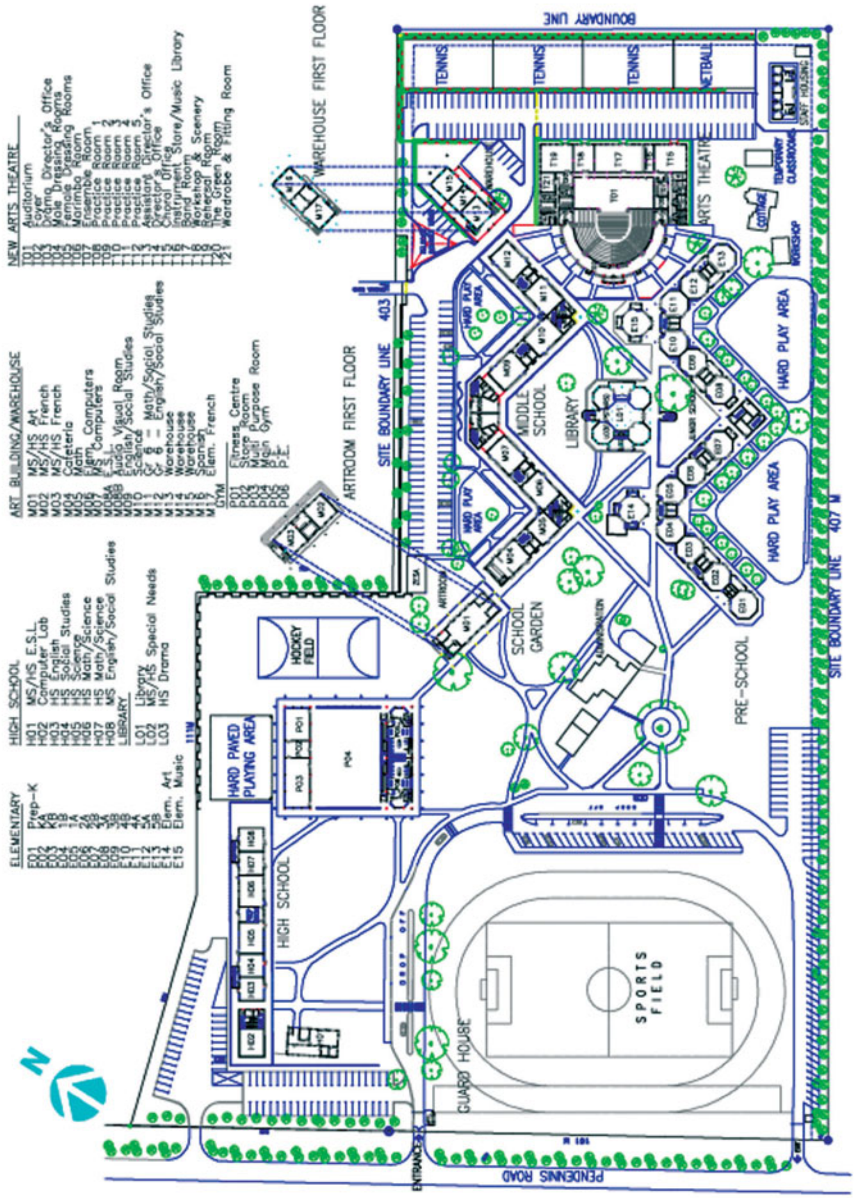
The unique constraints of the high-density urban population, climate and limited availability of land in Cairo created a challenge in designing an effective educational facility. The Manarah School is divided into four smaller building units with shady courtyard entrances and open space between buildings. The building design is compact, sensitive to site orientation and organized to limit travel between classrooms. All classrooms provide natural cross-ventilation.




Secondary
Elementary
Secondary & Primary entrance
Elementary entrance
Primary
Elementary
Playground Entrance
DR.HASSAN SABRY STREET
GARDEN
GARDEN

Case Study #24
Harare International School,
Harare, Zimbabwe
Architect: Pearce McComish. 2002.
20 acre site; 500 students
(Author: Jeffery A. Lackney)

Harare International School is an international school serving students from 55 countries ranging from 3 to 18 years of age. The building takes full advantage of sustainable design utilizing passive heating and cooling, diffused natural daylighting, and natural ecological groupings of indigenous trees and shrub plantings that are used in the curriculum. The school's chevron design of the two main classroom buildings makes for open, quiet, natural playing areas. The primary school classrooms are pod-like in design, allowing the teacher great flexibility in setting up teaching areas and workstations.


ELEMENTARY
E01 Prep-K
E02 KA
E03 KB
E04 1B
E05 1A
E06 2A
E07 2B
E08 3A
E09 3B
E10 4B
E11 4A
E12 5A
E13 5B
E14 Elem. Art
E15 Elem. Music
HIGH SCHOOL
H01 MS/HS E.S.L.
H02 Computer Lab
H03 HS English
H04 HS Social Studies
H05 HS Science
H06 HS Math/Science
H07 HS Math/Science
H08 MS English/Social Studies
LIBRARY
L01 Library
L02 MS/HS Special Needs
L03 HS Drama
ART BUILDING/WAREHOUSE
M01 MS/HS Art
M02 MS/HS French
M03 MS/HS French
M04 Cafeteria
M05 Math
M06 Elem. Computers
M07 MS Computers
M08A E.S.L.
M08B Audio Visual Room
M09 English/Social Studies
M10 Science
M11 Gr 6 – Math/Social Studies
M12 Gr 6 – English/Social Studies
M13 Warehouse
M14 Warehouse
M15 Warehouse
M16 Spanish
M17 Elem. French
GYM
P01 Fitness Centre
P02 Store Room
P03 Multi Purpose Room
P04 Main Gym
P05 P.E.
P06 P.E.
NEW ARTS THEATRE
T01 Auditorium
T02 Foyer
T03 Drama Director's Office
T04 Male Dressing Rooms
T05 Female Dressing Rooms
T06 Marimba Room
T07 Ensemble Room
T08 Practice Room 1
T09 Practice Room 2
T10 Practice Room 3
T11 Practice Room 4
T12 Practice Room 5
T13 Assistant Director's Office
T14 Director's Office
T15 Choral Office
T16 Instrument Store/Music Library
T17 Band Room
T18 Workshop & Scenery
T19 Rehearsal Room
T20 The Green Room
T21 Wardrobe & Fitting Room
N
HARD PAVED PLAYING AREA
HOCKEY FIELD
HIGH SCHOOL
ARTROOM FIRST FLOOR
WAREHOUSE FIRST FLOOR
SITE BOUNDARY LINE 403
ENTRANCE
GUARD HOUSE
SPORTS FIELD
PENDENNIS ROAD
SCHOOL GARDEN
MIDDLE SCHOOL
LIBRARY
HARD PLAY AREA
ADMINISTRATION
PRE-SCHOOL
JUNIOR SCHOOL
ARTS THEATRE
TENNIS
NETBALL
BOUNDARY LINE
COTTAGE
WORKSHOP
TEMPORARY CLASSROOMS
STAFF HOUSING
SITE BOUNDARY LINE 407 M

Schools as Living, Empowering Places

Schools should be places that empower their occupants to learn and live, by means of the kind of teaching offered and through the design of the buildings themselves. They should be places with a very special charisma, making a positive impact on enjoying learning and life itself.

There are places in buildings and towns that are especially captivating, impressive or stimulating. Unfortunately, such places are not usually to be found among the products of so-called modern architecture. Looking at any architecture magazine on the subject of building schools will horrify any real educationalist. A Swedish proverb says that the children are the first teacher, the teachers the second, and the school building the third. In other words, the school is the very place that should be designed to have those powerful qualities.

Human beings cannot survive in hostile environments without clothes and a house, so they have had to learn to house themselves. They have so internalized this that even as small children they instinctively start to build a protective envelope for themselves.

People need houses, and at the same time are capable of building houses. Housing ourselves is one of our primal needs and primal abilities, with the emphasis on "ourselves." Involvement in the building process is crucially important for later acceptance of the house and identification with its four walls.

We have experienced this in building many family homes, and especially designing schools and other buildings for young people, where future users took part in the planning and building process. Physical involvement in building is not just a technical, but a social process. For millennia, building was a community process, neighborhood help and an initiation ritual, and was tied into a society and its traditional practices.

Our architectural practice, plus+ Bauplanung, has built eight youth clubs, which came into being largely through self-help. The result, as Peter Blundell Jones describes so vividly and expertly in his book about our work Building as a social process (2006), was that the buildings are treated lovingly and looked after well, and have remained largely free of any signs of vandalism.

We thought at first that the reason for this was that the young people directly involved in the building process felt protective towards their own product. But this theory became less and less credible from year to year, as the buildings became older but still remained intact, while the original young builders had dispersed to the four corners of the earth. But still, subsequent young users insist that they had built their accommodation, even though they were not even born at the time of construction. So it seems that it is not only the builders who protect their building, but that it is the building itself which proclaims the unique way in which it was made, the story of how it came into being, and the immense effort invested in it. It seems as though the building is telling the story of the love and devotion that brought it into being.

Houses that are loved have an identity and individuality of their own, which lifts them out of anonymous uniformity. This becomes entirely comprehensible when we compare it with clothing. In both cases, it is only individual quality that leads to real identification and affection. Clothes and houses have to meet emotional and social needs as well as performing their function. If houses are not to be merely protective huts, but also create a space in which individuals and the group can live, they have to perform a range of complex tasks. A house cannot be a purely technical and cognitive construct, but must meet a wide range of emotional and social needs.

The buildings for young people were realized on a self-help basis in the period from 1983 to 1992. Later on, our projects became larger and more complex. This meant that realization by the individuals in the construction process inevitably decreased, but participation in the planning process remained, especially in the case of schools. This approach is described in step by step detail in our book Kinder bauen ihre Schule/Children make their school. Evangelische Gesamtschule Gelsenkirchen (2005).

We learned that involving users in planning, taking people's requests seriously and discussing the various possible solutions thoroughly is an extremely laborious and time-consuming process, but always a productive and successful one. It seems to be more important than self-help at the building stage and leads to the same feeling of a self-determined, tailor-made design solution, and also to a high level of identification with the building. It seems as though the particular ambience, the uniqueness or even something like the aura of the building is captured in what is actually a dead object, through the personal involvement and devotion of many people (preferably the future users). Then, the building is able to proclaim: "I am a real individual, a living organism and I am all this especially for you, who recognize me. I am an essential part of your entire personality!"

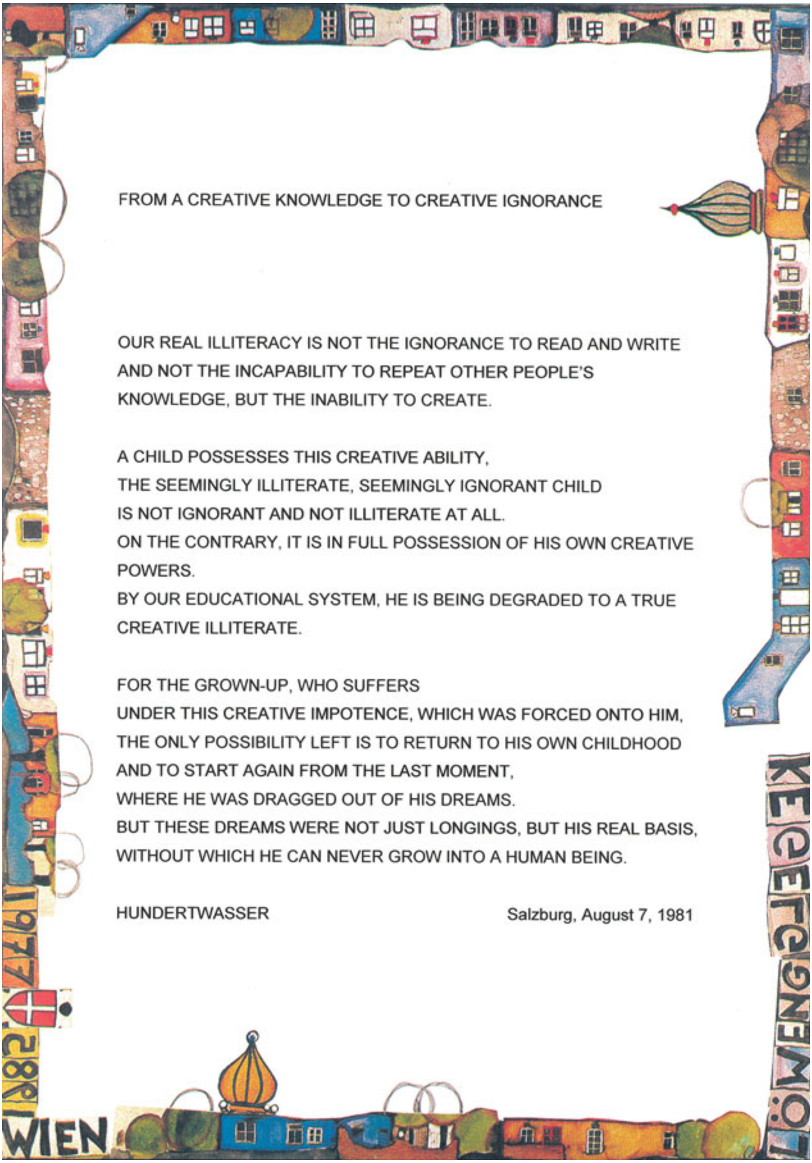
People are inclined to personalize the things that surround them, and language reveals this: “That poor old house,” “that fragile chair, “that beloved vase.” In his 1998 book The hand, Robert T. Wilson vividly explains the connection between grasping with the hand and grasping with the mind. He shows that in terms of developmental history, the hand was there before the brain. Because early humans were able to oppose thumb and index finger, their hands developed into astonishingly sophisticated “tools.” This extraordinary dexterity of early man made it essential to develop communication and hence a larger brain. Making things and developing complex manual skills is still one of the essential building blocks of good education. Hand, heart, and mind should be developed to an equal extent at the same time.

Children grasp (again this word with two meanings) and comprehend the world in their immediate vicinity with all their sensual organs, the mouth, the skin, the nose, the ear, and the eye. This is crucially important for our observations of what could make schools into living, empowering places: Only environments that stimulate and flatter all senses, keep them awake, are fit for human beings. Little children are already familiar with the nature of many subjects and objects. They can identify them by taste, smell, sound, and structure, not just by their appearance, and can remember positive and negative experiences. They have learned to distinguish between hot and cold, loud and quiet, hard and soft, sweet and sour, smooth and rough, sharp and blunt, and so on. They have learned to distinguish between things that please and things that hurt, between good and bad things, as it were.

The parallels with the way we perceive architecture are obvious. Buildings and towns are also taken in by all our senses. In order to design spaces that bring pleasure to the senses, they have to be thought and invented into being using all the senses, not just with the eye and for the eye. This is not advanced very much by architecture periodicals with their carefully composed photographs of spic-and-span buildings without any people and furniture in them. At worst, they are setting trends and serving as models for the next generation of architecture students with examples that fail to meet people’s actual wishes and basic needs.

People are able to spontaneously feel positively or negatively affected, touched or accepted by objects, materials, structure etc. A schoolgirl does not have to touch a bare concrete wall to realize that she doesn’t like it. Her experience tells her: cold, rough, dusty, and thus not pleasing to the hands, not a home-like place. And she wants to do nothing but get away. A child does not have to walk down that straight long corridor to know that it is boring, predictable, not an adventure. There is no escaping it either, so better just don’t set off down it. And a teacher doesn’t have to try teaching in a traditional boxy classroom to know that it is like being in a barracks, nothing like home, certainly not a living space. And that it offers no help in teaching. Most of our senses respond negatively, and not with sympathy. Schools for the future, the children who will learn in them, and the teachers who teach there, they all deserve better.

Peter Hübner
(Translation by Michael Robinson)



FROM A CREATIVE KNOWLEDGE TO CREATIVE IGNORANCE

OUR REAL ILLITERACY IS NOT THE IGNORANCE TO READ AND WRITE
AND NOT THE INCAPABILITY TO REPEAT OTHER PEOPLE'S
KNOWLEDGE, BUT THE INABILITY TO CREATE.

A CHILD POSSESSES THIS CREATIVE ABILITY,
THE SEEMINGLY ILLITERATE, SEEMINGLY IGNORANT CHILD
IS NOT IGNORANT AND NOT ILLITERATE AT ALL.
ON THE CONTRARY, IT IS IN FULL POSSESSION OF HIS OWN CREATIVE
POWERS.
BY OUR EDUCATIONAL SYSTEM, HE IS BEING DEGRADED TO A TRUE
CREATIVE ILLITERATE.

FOR THE GROWN-UP, WHO SUFFERS
UNDER THIS CREATIVE IMPOTENCE, WHICH WAS FORCED ONTO HIM,
THE ONLY POSSIBILITY LEFT IS TO RETURN TO HIS OWN CHILDHOOD
AND TO START AGAIN FROM THE LAST MOMENT,
WHERE HE WAS DRAGGED OUT OF HIS DREAMS.
BUT THESE DREAMS WERE NOT JUST LONGINGS, BUT HIS REAL BASIS,
WITHOUT WHICH HE CAN NEVER GROW INTO A HUMAN BEING.

HUNDERTWASSER Salzburg, August 7, 1981